WHEN WINTER "BEARS DOWN"

Cold weather makes rails contract and slack back, but

FAIR RAIL ANTI-CREEPERS

meet the test, even though buried in snow and ice and frozen solidly into the road-bed. Vertical loads or pressure from either direction does not loosen their tremendous grip on the rail!

CHICAGO **THE P. & M. CO.** NEW YORK

MONTREAL PARIS

One of America's Famous Trains

THE DIXIE FLYER

THE NASHVILLE, CHATTANOOGA & ST. LOUIS RAILWAY

THE DIXIE FLYER, through train operati
between Chicago and Jacksonville, Flori
is seen here a few miles north of Chattanoo
Tennessee, as it runs through the Lookout Moun-
tain territory. In constant operation for many
years, THE DIXIE FLYER operates over five lines
namely, the C & E I, L & N, N C & St. L, Cen
of Georgia and Atlantic Coast Line. All
cars are air-conditioned. Track
more important as train speeds incre
vital to passenger comfort. For mod
the need for track washers at rail
by HY-CROME *Spring Washers*—
cial purposes and to meet A.

Reliance HY-CROME *Spring Washers*

REActive Deflected	THACKERAY	HY-REACTION	STANDARD	HEAVY DUTY	DOUBLE	BOND
Meets A. R. E. A. Spec.	*For screw spike use*	*For track bolts*	*For general use*	*For frogs—crossings*	*For special use*	*Used as*

CHICAGO

EATON MANUFACTURING CO. RELIANCE SPRING WASHER DIVISION, MASSILLON, O

MEETS MODERN *HIGH SPEED* REQUIREMENTS

and complies

At Space 165
National Railway
Appliances Association
Exhibit

with A.R.E.A. STANDARDS *in every respect*

THE Lundie is the safe and economical Tie Plate for modern high speed schedules. By reason of its scientifically designed bottom, the Lundie Plate not only prevents the spreading of track and holds gauge, but minimizes tie destruction and saves maintenance expense in regauging and surfacing. The Lundie Plate has no tie destroying projections and does not cut a single tie fibre. It prevents slipping and relieves the thrust on the spikes. Lundie Plates are made with single or double shoulders to comply with A. R. E. A. specifications or can be furnished to meet your own specifications. Over 200,000,000 in service prove that Lundie Tie Plates reduce costs and improve track.

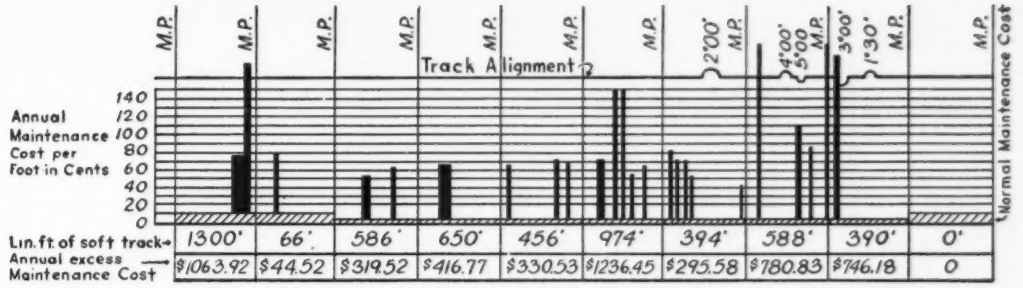
THE LUNDIE ENGINEERING CORPORATION

Tie Plates—Ardco Rail and Flange Lubricator

19 West 50th St., New York — 59 E. Van Buren St., Chicago

LUNDIE TIE PLATE

Published monthly by Simmons-Boardman Publishing Company, 105 W. Adams St., Chicago, Ill. Subscription price, United States and Possessions, and Canada, $2.00; Foreign $3.00. Single copies 35 cents. Entered as second-class matter January 20, 1933, at the postoffice at Chicago, Illinois, under the act of March 3, 1879, with additional entry at Mt. Morris, Ill., postoffice. Address communications to 105 W. Adams St., Chicago, Ill.



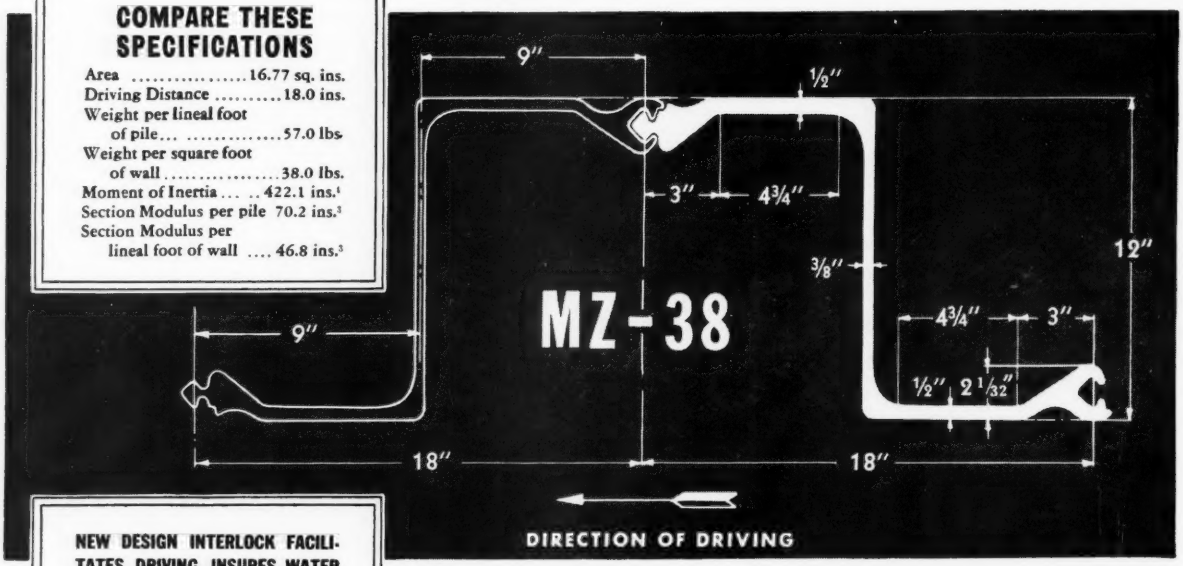
—Chart showing excess maintenance cost per mile of soft, wet track.

Offering "HIGHEST BEAM STRENGTH COMPARED TO WEIGHT"

CARNEGIE-ILLINOIS "Z" PILING

COMPARE THESE SPECIFICATIONS

Area	16.77 sq. ins.
Driving Distance	18.0 ins.
Weight per lineal foot of pile	57.0 lbs.
Weight per square foot of wall	38.0 lbs.
Moment of Inertia	422.1 ins.^{4}
Section Modulus per pile	70.2 ins.^{3}
Section Modulus per lineal foot of wall	46.8 ins.^{3}



NEW DESIGN INTERLOCK FACILITATES DRIVING, INSURES WATER TIGHTNESS, PRESERVES ALIGNMENT

In this *improved* ball-and-socket interlock, a triangular shaped ball with metal balanced both on ball and socket ends introduces a double locking feature which gives maximum water tightness, reduces tendency of piling to creep and twist in driving, minimizes swing in the interlock, permanently preserves alignment.

Further, the concentration of metal in the triangular-shaped ball greatly reinforces ball against curling during hard driving and facilitates the use of long sections in hard bottoms.

INTERLOCK WELDING UNNECESSARY

Interlocks are located where longitudinal shear is zero—the section modulus of the single uninterlocked pile is thus the same as when interlocked. No welding of interlocks is necessary to prevent slippage due to longitudinal shear.

RUGGED TO RESIST BATTERING

Note the heavy concentrations of metal at the four exposed points. They stiffen the pile against battering, make it especially suitable for deep water structures.

A new, more economical construction for long spans and heavy lateral loads

IN introducing MZ-38—the first "Z" Piling to be rolled in this country—Carnegie-Illinois Steel Corporation offers you a Steel Sheet Piling having the highest beam strength for its weight developed to date. *Two-and-a-half times as efficient* as any sections produced in America. Considerably more efficient than "Z" sections produced elsewhere.

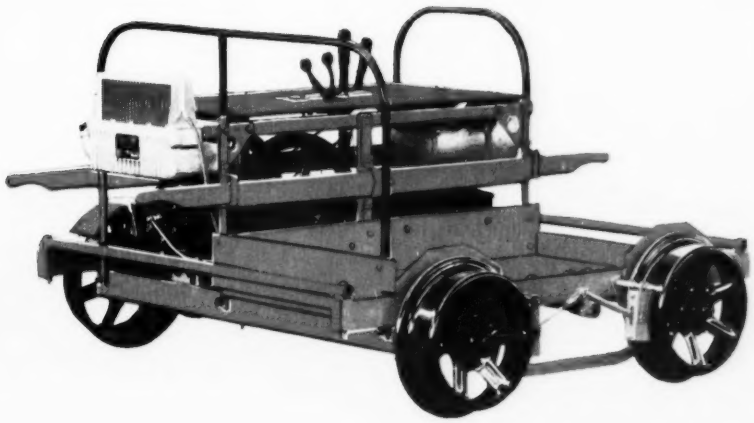
Consider these figures:—MZ-38 has section modulus per lineal foot of wall of 46.8 inches — yet weighs only 38 pounds per square foot of wall — 57 pounds per lineal foot of pile. The reasons are obvious why MZ-38 will assure particularly economical construction for wharves, piers, bulkheads, docks, sea-walls, canal locks and similar structures retaining heavy lateral loads over long spans.

A sixteen-page addition to our Piling Catalog fully describing these new "Z" Piling sections, is now in the mails. Be sure you get a copy. Our engineers are always ready to cooperate with you and will gladly furnish any additional information you may require.

CARNEGIE-ILLINOIS STEEL CORPORATION
Pittsburgh . . . Chicago
Pacific Coast Distributors: Columbia Steel Company, San Francisco
Export Distributors: United States Steel Products Co., New York
United States Steel Corporation Subsidiaries

UNITED STATES STEEL

ONE TO TWO-MAN INSPECTION CAR



This light car has a record of economy performance on many jobs ranging from inspection to the lighter end of section work. A sturdy white oak frame gives it great light-weight strength and cushioned riding comfort with safe room for bulky loads. The Fairmont 5-8 H.P. Engine delivers ample and dependable power with a liberal margin for the emergencies that always arise in railroad work. Its adaptability to so many jobs and its easy handling by one man combined with its low operating cost are all reflected in its popularity.

59 SERIES C

Performance ON THE JOB COUNTS

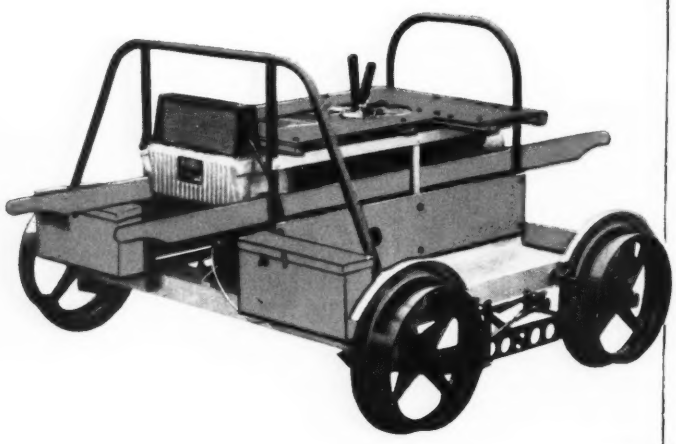
Fairmont

STANDARD SECTION CAR

S2 SERIES D

This steel frame car seats seven to eight men and has features or power and strength that qualify it for heavy B & B or extra gang work. Its 8-13 H.P. engine has proved through years of service that it delivers the surplus power needed in a car like this and the addition of a two-speed geaf practically doubles the draw bar pull for starting and hauling heavy loads. The durability of the steel frame has been proved through years of service and performance has shown that this car has both the power and stamina to pull 17,500 lbs. of loaded trailers at 15 miles per hour on level track. It is designed for comfort and safety and rides like a pullman.

ONE TO TWO-MAN INSPECTION CAR—ALUMINUM



M9 SERIES B

Aluminum alloy frame and 89 aluminum parts give this M9 the lightweight construction (a lift of only 85 lbs.) so necessary to easy one-man handling; they give it the strength for long and continuous hard service, and they give it flexibility that absorbs shock and vibration for a new degree of riding comfort. Its power plant is the famous economical Fairmont 5-8 H.P. Engine, noted for its even flow of power at all speeds . . . also for its dependable surplus to take care of peak loads, steep grades, and tough going. The M9 has built its own reputation for two-way economy—low operating cost and low maintenance cost.

Performance ON THE JOB COUNTS

Fairmont

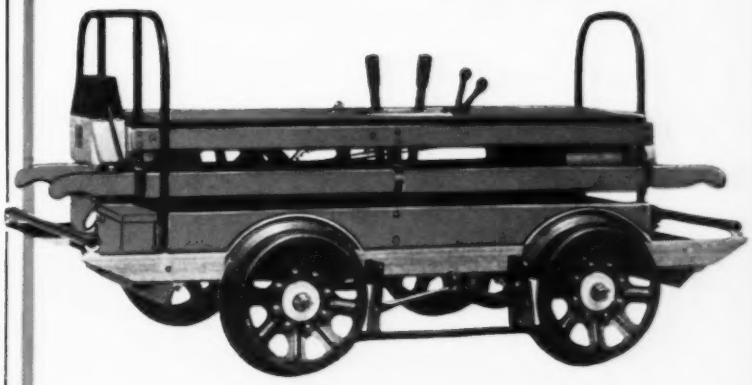
M19 SERIES D

ONE TO FOUR-MAN INSPECTION CAR—ALUMINUM

This car has an outstanding record of performance and is now presented with an outstanding improvement—a frame of aluminum alloy and 89 aluminum parts, reducing its lift to 90 lbs. Otherwise it is the same husky Inspection car that railroad men have known for 14 years. There has been no sacrifice in rugged durability and it is spring mounted to make it the smoothest riding inspection car in the field. The fact that the M19 is equipped with the same Fairmont 5-8 H.P. Engine that powers five other Fairmont cars is sufficient guarantee of dependable economical performance.

LIGHT SECTION CAR—ALUMINUM

Aluminum construction furnishes the combination of super strength and lightness of weight that qualifies this car for every job from one-man patrol to light section work carrying 6 men and equipment. This flexibility of service saves investment in extra equipment and even that service may be extended to the heavy duty field by the addition of a 2-speed gear for extra pulling power. The aluminum alloy frame and 70 aluminum parts give the M14 a lift of only 90 lbs. Here again surplus power is supplied by the Fairmont 5-8 H.P. Engine which has established its record for economical and dependable year-round performance.

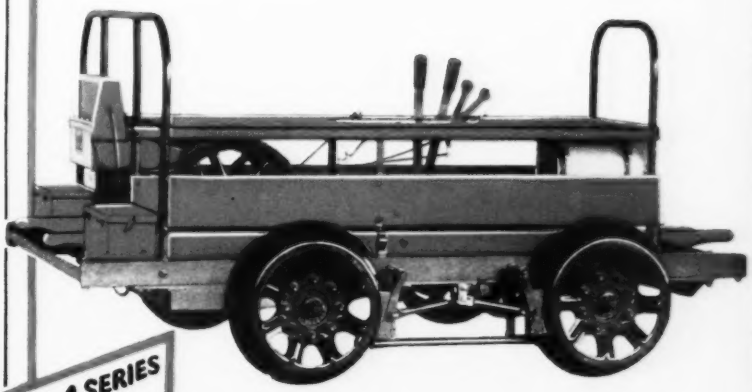


M14 SERIES D

Performance ON THE JOB COUNTS

Fairmont

This is a lightweight car developed to meet the preference for steel frame construction. The lift is held to 140 lbs. so that it has the lightness of weight for one-man handling and the rugged strength for section work. There is economy in this car from its ability to handle a wide variety of jobs and there is operating economy in its flexible power plant—the same Fairmont 5-8 H.P. Engine used on five other Fairmont cars, adding to the advantage of all around operating economy the further saving of smaller stock requirements for replacements through interchangeability of parts.



M14 SERIES E

ONE TO SIX-MAN SECTION CAR

A 4-cylinder 33 H.P. industrial type engine, in conjunction with a four-speed transmission, equips the A5 for heavy duty service usually handled by cars of greater weight. The roomy well designed body of white oak is mounted on a rugged structural steel frame, holding the weight to 1,700 lbs. for easy handling.

There is also the A3 B & B and Extra Gang Car with power and lightweight strength that fits it into every gang job—power and stamina for hauling a full gang of 60 men on trailers; yet light enough to be easily set off or on track by three men. A 15 H.P. four-cylinder engine and 4-speed transmission furnishes power with a surplus.

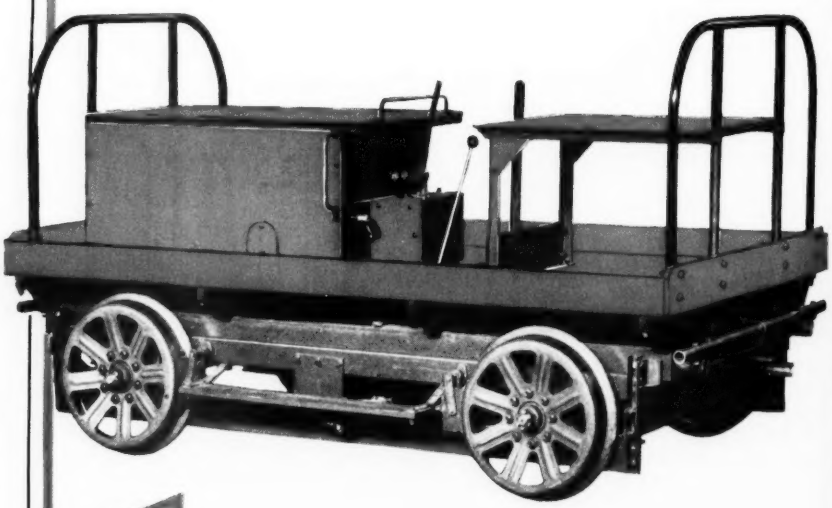
A5 SERIES B

GANG CARS

Performance ON THE JOB COUNTS

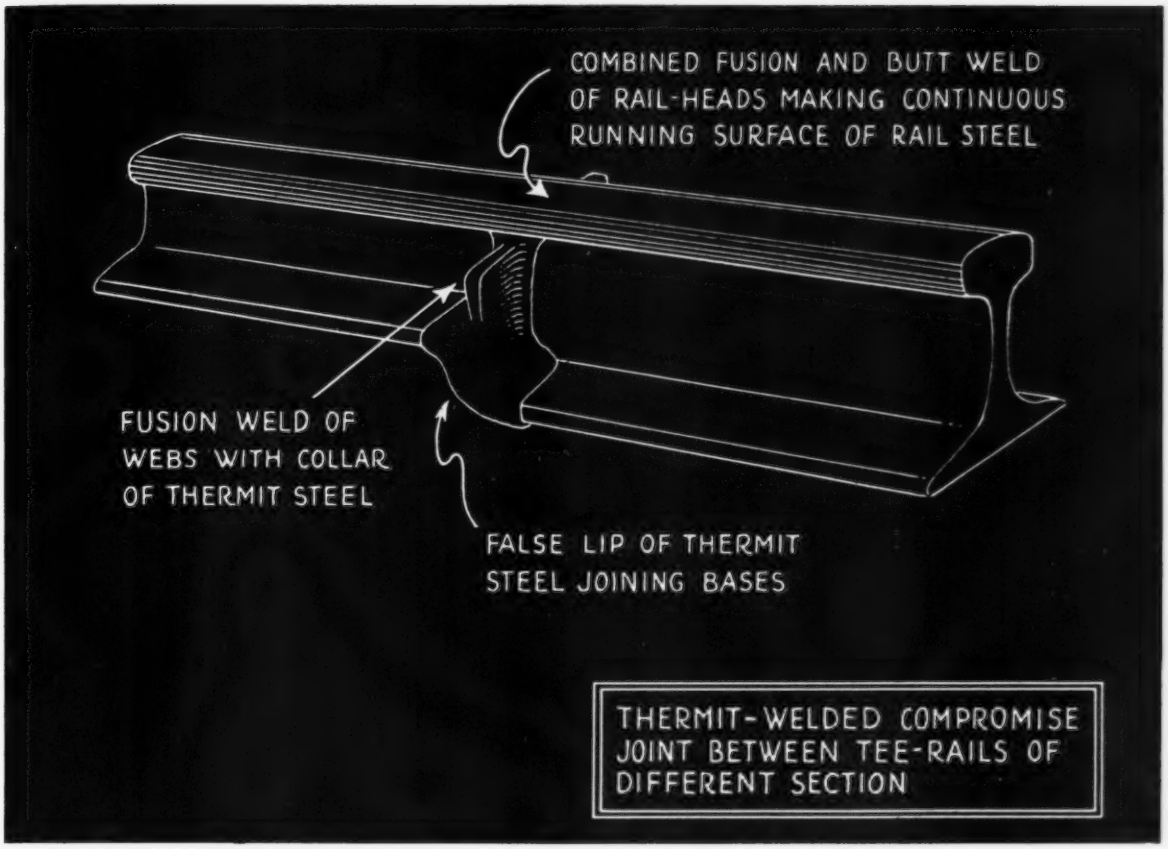
Fairmont

Fairmont has designed this car for heavy duty service, hauling heavy trailers, discing and ballast dressing . . . the kind of jobs where maximum drawbar pull must be continuous and dependable. It may be equipped with a Ford Model B or V8 engine, with a heavy duty transmission, 3 speeds in either direction for convenient movement of the car without turning on tracks. The structural steel frame embodies new methods of spring suspension (the same method as used most successfully on the Fairmont line of coaches). Large and ample tool tray space is available. This is truly an ideal heavy duty car with both power and durability.



A6 SERIES B

LARGE EXTRA GANG CAR



Design for

A TROUBLE-FREE COMPROMISE JOINT

Compromise joints made by Thermit Welding together two rails of different section are permanent and require no maintenance. Thousands of such joints are now in service and are proving satisfactory in every respect.

These joints cannot cup because the heads of the two rails are formed into one with no gap for wheels to pound; no rail ends to batter. There are no plates to cause trouble, no nuts to require frequent tightening. Once installed, a Thermit compromise weld can be forgotten completely.

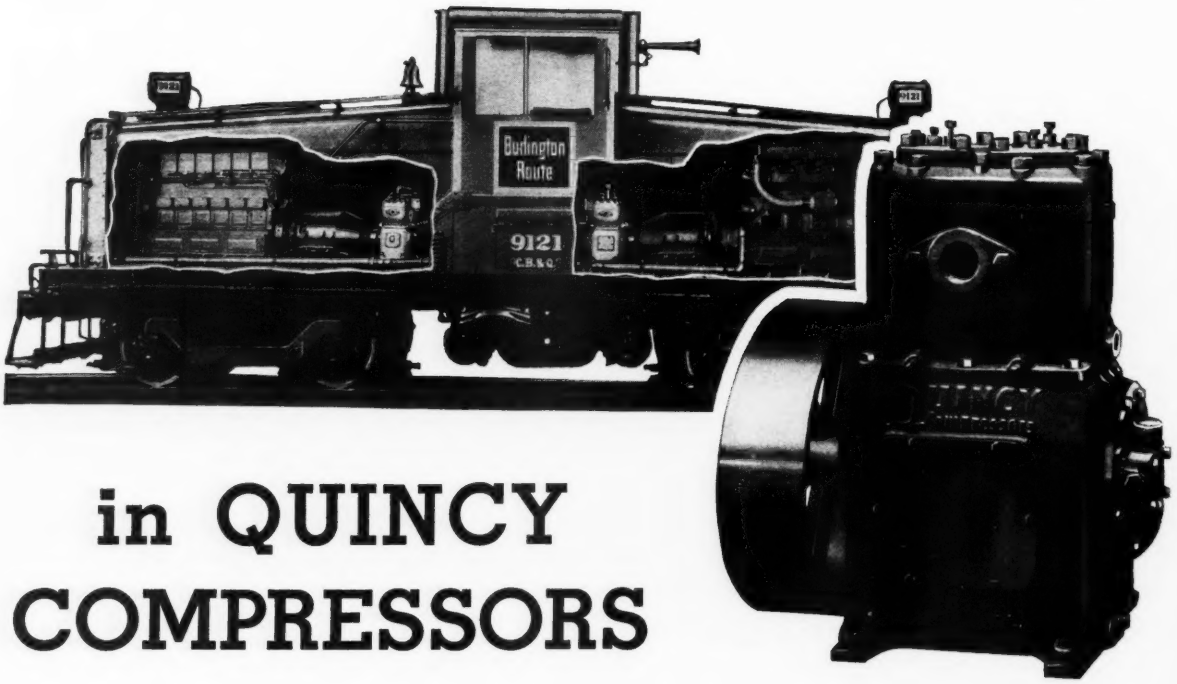
And, Thermit compromise welds can be put in at less cost than ordinary compromise joints. Like frogs and other special track work fabricated by Thermit Welding, they can be made at the maintenance-of-way shop by your own men. Any two types of rail can be joined—there are no limitations. Write and ask to have our nearest representative drop in and give you the details. No obligation, of course.

THERMIT *Rail* WELDING

METAL & THERMIT CORPORATION, 120 BROADWAY, NEW YORK, N.Y.
ALBANY • CHICAGO • PITTSBURGH • SO. SAN FRANCISCO • TORONTO

DEPENDABLE

HIGH SPEED PERFORMANCE



in QUINCY COMPRESSORS

Irrespective of the bearing service factors involved in your equipment — speed, load, alignment preservation or a combination of all three, Timken Bearings will give you dependable, low cost performance.

For example, the Quincy Model WW-64 Water Cooled Duplex Compressors installed in this modern Diesel-electric locomotive are subject to continuous operation at 1000 R.P.M.

This is considered unusually high speed for reciprocating compressors, but with the crank shafts mounted on Timken Bearings, friction is foiled and smooth, dependable performance assured.

In addition the crank shafts are protected against radial-thrust loads and held in correct alignment constantly—with resulting extension of compressor life and reduction of maintenance cost. It pays to specify Timken-equipped.

THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO

TIMKEN *TAPERED ROLLER* BEARINGS

MAKE CURVES LIKE TANGENTS
In Safety—In Maintenance Economy

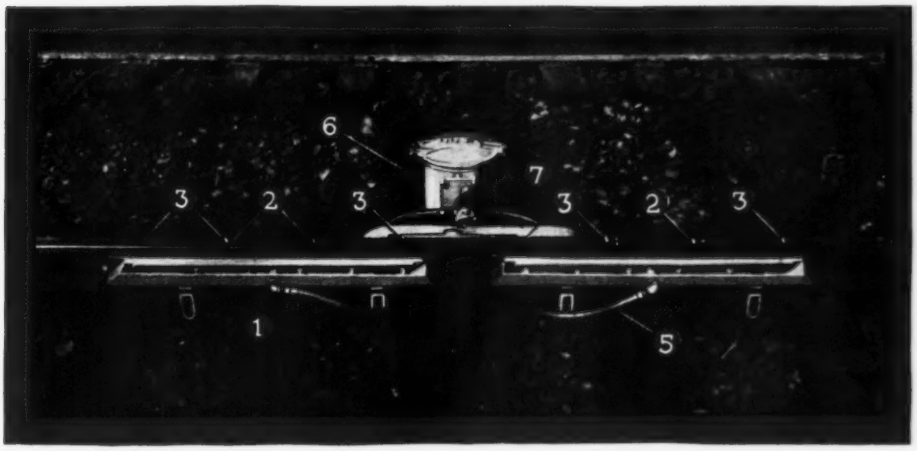
DECREASE Maintenance Labor, Rail and Tie Renewals, Wheel Flange Wear, Curve Friction, Train Resistance, Fuel Consumption, Derailment Hazards.

INCREASE Safety, Rail and Tie Life, Allowable Train Speeds, Tonnage Ratings, Locomotive and Car Wheel Life.

Meco Lubricators are actuated by the wheel treads, not by the flanges, and therefore lubricate just as positively and uniformly on wheels with worn or sharp flanges as on new wheels.

Practical design, rugged construction and positive, uniform service under millions of wheel contacts, enable us to guarantee that Meco Lubricators will work satisfactorily under all roadbed, track, traffic, temperature and climatic conditions. Let our experts analyze your curve territory and show what Meco Lubrication will save you.

MECO RAIL AND FLANGE LUBRICATORS



- No drilling necessary. Rugged universal clamps fasten MECOS to rail.
- Graphite Paste Lubricants function satisfactorily the year round.
- Lubricant equally distributed around *entire* circumference of Wheel Flange.
- Lubricant Distributing Bars are adjustable to suit various conditions of rail and train service.
- Small volume of lubricant on discharge side of pump prevents wasteful "surging" of lubricant after train has passed.
- Lubricant easily replenished. Closed container insures protection from rain or foreign material.
- Tread operated pumping mechanism, easily adjustable.
- Rugged construction throughout.

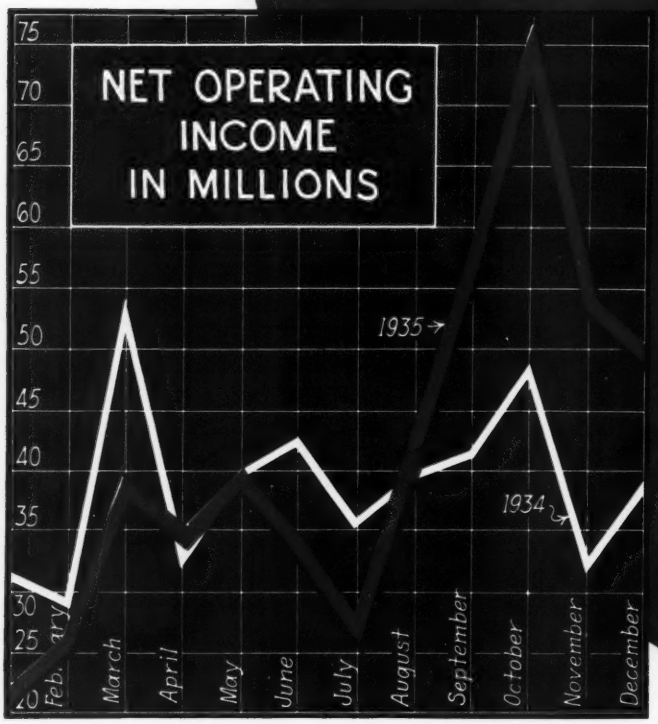
Over 2300 of our Rail and Flange Lubricators have been installed on more than 95 railroads, and more than 1800 of these are of the Meco design.

Pioneers in the Development of Rail and Flange Lubricators

MAINTENANCE EQUIPMENT CO.
Railway Exchange Bldg.
CHICAGO

TO RAILWAY SUPPLY MANUFACTURERS

Railway Purchases Follow Railway Earnings



In the first seven months of 1935, net railway operating income *declined* $44,644,235.

Yet in the last four months of last year, it was *larger* than in the last third of any year since 1930—a gain of $74,000,000 over 1934.

And freight loadings are still running at the highest level for five years—nearly 10 per cent larger than a year ago, while all indications point to continued acceleration throughout the year.

Increased earnings lead to increased buying. Enlarged maintenance programs are now in the making.

Already, the roads have ordered 475,000 tons of rail since October 1—three times as much as in the same period last year. Other materials and equipment are being requisitioned in increasing quantities.

Are you organizing to secure your share of this business? Are you presenting the story of your products to the men who are determining which work shall be undertaken this year?

Are you including in your sales program a schedule in Railway Engineering and Maintenance that will keep your products throughout 1936 before those railway officers who will prepare and carry out these programs and select the materials and equipment therefor?

RAILWAY ENGINEERING AND MAINTENANCE IS READ BY MAINTENANCE OFFICERS OF ALL RANKS

OXWELDING
reduces switch point and frog maintenance

IN OR OUT OF TRACK—Frogs and switch points can be oxwelded in track or where changing-out is possible can be brought to a central shop for building up. Either method is effective when done under Oxweld procedures.

● Modern high speed train service inflicts severe penalties on switch points and frogs. Wear is rapid, yet safety standards demand that these vital portions of track be kept at a high degree of operating efficiency. To meet these new conditions, many of the leading railroads have turned to oxwelding as a ready means of restoring worn switch points and frogs at relatively small cost.

Oxwelding makes worn switch points and frogs equal to new, enables them to withstand better the wear of heavy traffic. Upkeep costs are lowered. The roads requirements of new replacement units are substantially reduced by this simple, easy and economical method of repair.

The Oxweld Railroad Service Company has developed low cost methods and techniques of making switch point and frog repairs and extends the fullest cooperation to its railroad clients in organizing this work, in or out of track. The majority of Class I railroads have been Oxweld clients for nearly a quarter of a century.

THE OXWELD RAILROAD SERVICE COMPANY
Unit of Union Carbide and Carbon Corporation

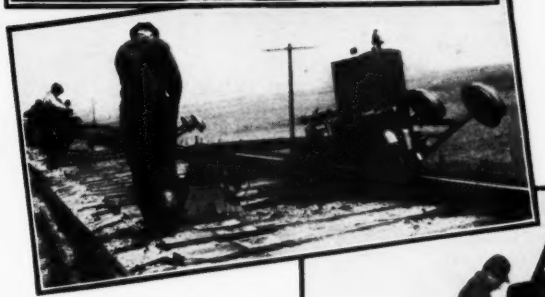
UCC

NEW YORK:
Carbide and Carbon Bldg.

CHICAGO:
Carbide and Carbon Bldg.

OXWELD RAILROAD SERVICE

Save time and money . . get better track by putting these Nordberg maintenance tools on the job



A new Track Wrench and a new Precision Rail Grinder are the latest additions to the Nordberg Line of Track Tools. One reduces the expense of joint maintenance by keeping the bolts uniformly tight; the other by providing smoother riding joints on welded rail and by removing mill tolerance.

Then, there are the Utility and Surface Grinders, one an all-purpose tool for slotting rail ends, switch maintenance, etc., the other for heavy duty grinding.

When laying rail, the Adzing Machine and Spike Puller are necessary for speed and low cost rail laying. On ballasting and surfacing work, the Power Jack speeds up operations. Each of these machines has an essential part to play on every track maintenance and betterment program.

At The Show

See this Nordberg Line of Maintenance Tools on display at the National Railway Appliances Exposition, Coliseum, Chicago, March 9 to 12, inclusive.

NORDBERG MFG. CO.
MILWAUKEE, WIS.

No. 87 of a series

Railway
Engineering and Maintenance

SIMMONS-BOARDMAN PUBLISHING COMPANY

105 WEST ADAMS ST.
CHICAGO, ILL.

Subject: DEVELOPING MARKETS

FEBRUARY 27, 1936

Dear Reader:

Have you ever thought of the service that a publication like Railway Engineering and Maintenance renders its industry by creating markets for new products or new materials? Take our March issue as an illustration. For 18 years we have devoted this issue to the presentation of information regarding new devices and equipment designed to take drudgery out of maintenance work and regarding the more efficient use of this equipment. Supplementing as this does the consideration of this subject in our other issues from month to month, it serves to keep before maintenance officers the newer aids that are being developed for their use.

It is more than a coincidence that work equipment has received its greatest recognition from the railways during the period when Railway Engineering and Maintenance has served you. It was in May, 1911, that the Maintenance of Way Section of the Railway Age first appeared—the predecessor of Railway Engineering and Maintenance. In that first issue we presented a survey of the experiences of the railways with section motor cars which were then termed "a comparatively recent development" concerning which there were "widely divergent views among railway men." At that time such devices as tie tampers, adzing machines, rail laying cranes and bolt tighteners were unknown.

In the quarter century that has intervened, we have presented, month after month, experiences of individual railways with new tools or with new uses of old tools. Through constant focusing of the spotlight on these developments, the adoption of work equipment has been hastened. Through this publicity we have, I believe, contributed to the economy with which the railways have conducted their work. At the same time, we have aided in building for manufacturers of such equipment markets which aggregate millions of dollars annually.

Whether you are a railway man or a manufacturer of equipment for railway use, you have, I believe, profited from this service. What we are doing to promote the use of work equipment, we are endeavoring also to do in other maintenance activities and for other railway manufacturers.

Yours sincerely,

Elmer T. Howson

ETH*JC Editor.

MEMBERS: AUDIT BUREAU OF CIRCULATIONS AND ASSOCIATED BUSINESS PAPERS, INC.

● TRUE TEMPER Tapered Rail Joint Shims are supplied in graduations of "hundredths" in seven different thickness combinations.

Provides TRUE TEMPER TAILORED Fit for Each Individual Rail Section and Drilling

- Prolongs the Life of Rail and Fastenings
- Reduces Maintenance of Bolts and Joint Ties
- Improves Riding Quality of Track
- Eliminates inward bend of Bars due to worn fishing surfaces

THE AMERICAN FORK & HOE COMPANY

GENERAL OFFICES
CLEVELAND, OHIO

RAILWAY APPLIANCES DIVISION

FACTORY
NO. GIRARD, PA.

DISTRICT OFFICES
DAILY NEWS BLDG., CHICAGO, ILL.

113 CHAMBERS ST., NEW YORK, N. Y.

FOREIGN REPRESENTATIVES
WONHAM, INC.
44 WHITEHALL ST.
NEW YORK, N. Y.

68-72 WINDSOR HOUSE
VICTORIA STREET, LONDON, S. W.-1

Railway Engineering and Maintenance

NAME REGISTERED U. S. PATENT OFFICE

March, 1936

Published on the last Thursday preceding the month of issue by the

SIMMONS-BOARDMAN PUBLISHING COMPANY

105 West Adams Street, Chicago

NEW YORK
30 Church Street

CLEVELAND
Terminal Tower

WASHINGTON, D. C.
932 National Press Bldg.

SAN FRANCISCO
55 New Montgomery Street

Subscription price in the United States and Possessions, and Canada, 1 year $2, 2 years $3; foreign countries, 1 year $3; 2 years $5. Single copies, 35 cents each.

Member of the Associated Business Papers (A.B.P.) and of the Audit Bureau of Circulations (A.B.C.).

Railway Engineering and Maintenance

Dependability

Railways Prove Superiority

DURING the 30 days from January 20 to February 19, the middle west experienced the most severe weather conditions in its history. Not only did the temperature fall to extreme low levels repeatedly, but the cold was long continued. Accompanied by one snowfall after another, these conditions caused acute distress in many communities. They placed responsibilities of heroic proportions on all transportation agencies. It is interesting to note how these agencies met this emergency.

Take the waterways, to which so much attention has been given and for which so much money has been expended of late. Frozen over from bank to bank, they were unable to render any service when service was most needed. They were utterly valueless in this emergency as they are in any crisis during the winter months.

Scarcely less helpless were the airlines. Serving only the major metropolitan centers at best, to the exclusion of the far larger number of smaller cities and towns, they are in no way heavy tonnage carriers. Even in their limited service, however, their performance was most irregular and schedules were abandoned day after day. For dependability, their rating was also low.

The Highways

And on the highways demoralization of service was complete. With drifts 15 and 20 ft. deep, buses and trucks abandoned all attempts to provide service. Towns that had come to depend on highway operators for their transportation, suddenly found themselves completely isolated for weeks. In many of these communities, where railway lines had been taken up, suffering became acute. Even in towns served by the railways, many sources of supply of essential commodities had been broken up by highway competition. Especially in coal distribution, towns that had secured their supplies through small truckers hauling from nearby mines, found when this emergency arose that they were not only cut off from their source of supply but no longer had local coal merchants familiar with the routine of ordering and distributing coal from rail mines. Nor were these mines themselves prepared to take on this additional business.

As for the railways, faced with the most severe handicaps to operation in their history, they continued to render service. Their record, in the face of the greatest obstacles and the most trying conditions under which men could work, is one of great achievement. As told by the Burlington, one of the roads hardest hit, in an advertisement appearing in papers along its lines on February 24, "with one exception, no freight train was cancelled on any of the Burlington primary lines. As to all of the main lines, only one through train was cancelled (two trips) on the entire system, with four other trains operating on that particular run. Trains sometimes ran late—yes. If not on time, the lateness was usually a matter of minutes, although admittedly sometimes it was hours. But with the single exception mentioned, we gave service, freight and passenger, over all primary lines, westbound and eastbound, every day throughout the thick of it.

"As the sub-zero weather continued, and grew worse, the case resolved itself into a struggle to move passengers, food, fuel. The Burlington had what it takes to move them. It had the men and the machine; the big rotary snow plows to clear the tracks; the motive power and the cars."

A Great Task

This period placed a great task on railway men, and especially on those in the maintenance of way department, upon whom rested the responsibility for opening the lines for trains and for keeping these lines open, and these men rose to the emergency in a way that reflects great credit on them. In extreme cold, with faces cut by snow driven by high winds, and without protection of any kind, these men fought for long hours and, with a minimum of rest, returned again and again to the fight to keep lines open in order that communities might have food and fuel, in order that there might be no suffering among those who had long looked to the railways for this service—and also among those who had turned away from the railways of late years to the highways, only to find this newer agency of transportation failing in this emergency.

Typical of the devotion to duty displayed by maintenance officers throughout the stricken area was the action of a roadmaster who received orders to open a 20-mile branch line. When he received this order, the roadmaster was at one end of the line, while the available snow-fighting equipment was at the other end. With highways between the two points hopelessly blocked with snow, the roadmaster set out at 6 p. m. to walk the 20 miles. All night he trudged through the snow, stopping only once to thaw out and rest for an hour at a lunch stand. At 7 o'clock the following morning, he reached his goal and

in spite of frost bitten hands and feet, proceeded, without rest, to recruit a snow-fighting gang of 65 men.

This story of courageous personal sacrifice could be duplicated on every road in the snowbound area. It was characteristic of the manner in which maintenance of way men meet emergencies, whether they arise from blizzards, floods, dust storms, etc., in order that transportation may not fail. The story of the battle waged by maintenance men throughout the storm stricken area forms an epic in the history of American transportation.

Public Recognition

That this record is not without public recognition is evidenced by the many comments in the daily press. Quoting from an editorial in the Chicago American for February 21, "The railroads have demonstrated that they can compete successfully. Cross-country automobile and truck movements have been crippled most of the time since the cold spell began; now and then they have been halted altogether. Blizzards at times have grounded the airplanes. But the trains keep shoving along, bucking the drifts, feeling their way through blinding storms, sometimes losing time, but *getting there.* The truly great achievement of the railroads in the cold spell has been keeping the population fed and warm. Under the most difficult conditions imaginable, the railways have borne the added burden admirably."

Again, the Chicago Daily Drovers Journal, a paper serving the rural areas of the middle west, stated editorially on February 18 that "during the past month of unprecedented storms and cold, a good many people have had their eyes opened to their dependence on the railroads and have not failed to observe and to appreciate the heroic efforts made by railroad men to clear the tracks and move necessities. Men have worked for hours in sub-zero temperatures, facing winds that cut to the bone, in the almost hopeless task of shoveling "sugar" snow that refused to stay put. The people of the town that received a car of coal just as the local supply was exhausted do not need to be reminded of what they owe to the railroad men who, realizing their need, refused to quit when the wind threw the snow back in their faces and the frost bit deep. Even snow plows had to be dug out of the drifts by hard hand labor and in some cases, it was necessary to pass the snow from hand to hand up the sides of cuts. But the people must have coal; food must be moved to prevent starvation; animals enroute must be given any protection possible so that they will not freeze to death; and, finally, the trains must move, for it is the tradition of the rails."

An Achievement

Yes, the railways have again demonstrated that in times of emergency they are the one dependable agency of transportation to which the public can turn—an agency with the means and the man power to meet crises and to meet them with its own forces and at its own expense without calling on public funds to reopen its lines of travel.

This is a phase of railway service to which every employee can point with pride. It is a service which he should broadcast at every opportunity while the conditions are still fresh in mind. It should be brought especially to the attention of those persons who are inclined to turn, in fair weather, to other subsidized and less dependable competitors.

In our last issue we urged railway employees to stress the safety of railway service. To this should now be added dependability.

Work Equipment

Economy of Operation May Be Impaired

IN ANY consideration of the present status of work equipment and its potential economy, two factors stand out prominently. The first is that, with a few exceptions, the railways have bought so little of this equipment during the last six years that for practical purposes it can be said that they stand today exactly where they did on January 1, 1930. The second factor is that, in the main, those units that they then possessed have been used so intensively during this six-year period that some of them have been worn out and dismantled, while many of those remaining are now at or near the end of their service life. For this reason, the first of the foregoing statements must be qualified by eliminating those units which have been discarded in the meantime.

Other factors have also operated to affect the status of this equipment, such as the number of units available for the tasks they perform, the standard to which they have been maintained and the age of the individual units at the beginning of the depression period. That much of this equipment now in use is completely worn out or has reached the point where it can no longer be maintained economically, is confirmed by the statements of chief engineers and engineers maintenance of way on roads aggregating more than half of the operated mileage in the United States and Canada, which are given in detail on a following page.

It is self evident that if a machine can no longer be maintained economically, its operation will be inefficient and, therefore, uneconomical, as compared to one that is in good condition. Furthermore, no proof is needed that if it cannot be operated with economy, money is being wasted every day it is kept in service. These are basic principles which should be applied to every unit now in service, and they should be graded accordingly. Aside from the question of the direct economy of maintenance and operation, one must also consider the hazards involved to the workmen in attendance. Obviously, no machine which is at the end of its service life is as safe as it was when new.

In addition to these considerations, no officer responsible for the operation of work equipment should be satisfied until he has compared his machines with the later models that are now available. If he does this he is quite likely to find that his equipment is afflicted as much with obsolescence as with wear and tear. Not a few officers who have made this comparison report that they have been surprised at the relative inefficiency and lack of economy of their present machines.

Another article in this issue shows specifically that there is a dollar value in modern equipment, which cannot be ignored by the up-to-date maintenance officer.

Ample data of similar character are available for other types of equipment, enabling him to prove to his superior officers that they cannot afford, even in the face of purchasing difficulties, to allow him to continue the use of obsolete or worn-out machines when others are available which will quickly wipe out the investment through the savings which they can effect. The important thing is that he present his argument in convincing form.

Adequate?

How Well Should the Properties Be Maintained?

THE state of maintenance of a property is a controversial subject, which necessarily leads to differences of opinion. In the search for basic information, the investigator goes to the records of expenditures, with the comfortable feeling that if he interprets these correctly he should have no trouble in convincing others of the correctness of his conclusions. But such is often not the case; too much depends on the interpretation.

For example, in an effort to arrive at a figure representing the current accrued deficiency in the maintenance of the railways, one naturally turns to a comparison of their expenditures for maintenance during the depression years with those of the years immediately preceding. But this procedure is criticized on the ground that the test period chosen was one of intensive improvement of the tracks and structures and for that reason included many charges that really were not maintenance at all, but resulted from the widespread effort to develop a better property. If this is so, the determination of deferred maintenance will not be correct if it does not make some deduction for the money spent for improvements. But what about the need for further improvements in the fixed properties of the railroads? Is it to be assumed that the railroads were finished in the fall of 1929, when the crash came?

A bridge, a house, a dam, or even a fence must possess certain attributes of strength and stability to maintain its integrity; otherwise it will fall down, or one or more of its parts will become broken. But a track cannot fall down because it is already down, and only certain of its parts fail by breaking. This at once introduces two serious difficulties—it renders very difficult any sort of rational design for track such as is employed in proportioning the roof trusses of a building, and it eliminates any precise means of determining when a particular standard of track construction is inadequate for the traffic it carries.

Track of the conventional design cannot be classed as a permanent structure; in fact it is said of track that it is subject to progressive foundation failure from the day it is put in service. This position is borne out by the history of track construction, which is a story of repeated strengthening in an effort to keep pace with the ever-increasing weights of rolling stock until about 10 years ago, when the trend toward heavier cars and locomotives finally tapered off. But the strengthening of the track continued, because many railway engineers were convinced that heavier track would be cheaper because it would cost less to maintain.

However, regardless of these more or less theoretical considerations, the fact remains that tracks on most main lines of America were much stronger in 1929 than they were in 1920. But were they strong enough? Had the ultimate been reached in track construction? Or is there still room for further improvement, even though no general increase in the weight of rolling stock need be expected? If the end was reached in 1929, then we must assume that it was a most fortuitous circumstance that delayed the depression just long enough to permit the railroads to put their house in order. On the contrary, it is much easier to support the position that the trend toward stronger track was retarded by financial considerations rather than because the job was completed.

Stronger track does not necessarily mean heavier rail, although it is doubtful if the end in that direction has been reached, but beyond any question it means better fastenings and better track support. Whether the efforts to gain the latter end will be confined to better ballast and roadway construction, and all that that implies, or whether better support will mean something radically different, the fact remains that many things can be done to improve track. It is unthinkable that the day of improvement in track has passed. This being so, it is fair to say that the deficiencies in the maintenance expenditures of the railroads are made up both of the inadequacies of the outlay for what may be termed current repair and upkeep and of the curtailment of those activities of past years that were making for an ever stronger and more permanent construction. While the former have a more direct bearing on the safety of rail transportation, the latter are just as important when it comes to the effectiveness and ultimate economy of operation.

Selling

Why It Is Not Always a Pleasant Job

IT was not without some misgivings that we invited several railway officers, a year ago, to put down on paper what they thought about supply salesmen. Few articles in *Railway Engineering and Maintenance* have aroused more interest and comment than the contributions of these men. Several railway supply companies requested additional copies of the magazine, in order that their salesmen might read this critique of their craft.

The other side of this picture is presented in the series of short articles beginninfg on page 164 of this issue, in which seven supply men tell why their work is not always as pleasant as it might be. From a practical standpoint, the articles last year told how the practices of the salesmen interfered with the work of railway officers; the articles in this issue tell how the practices of railway men in their relations with salesmen result in increased costs of sales and, therefore, in higher prices for what the railroads must buy.

In each series, the contributors made it plain that they were describing the exceptions—the horrible examples—and not men who are typical of the groups as a whole. But even if this be true, there is a lesson in these articles for the man who has not, normally, been guilty of the objectionable practices cited.

How Far Is

TO WHAT extent have expenditures for maintenance of way and structures been inadequate since the advent of the depression? During the last six years the Class I railways spent $2,660,000,000 for this purpose; they should have spent in the neighborhood of $3,700,000,000. In other words, their outlay for maintenance of way and structures was deficient to the extent of about $100,000,000 in 1931, and an average of about $240,000,000 in each of the following years.

The estimate on which these figures is based is a conservative one. It takes into account the effect of the decline in operating charges on account of the almost complete cessation of additions and betterments work during the depression; it assumes that 40 per cent of the maintenance expenditures are influenced by traffic (33 1/3 per cent is the commonly accepted figure); and that the expenditures of the last six years were 20 per cent more effective than those of the predepression period by reason of reduced prices, lower wages and increased efficiency of labor.

Two Factors

It may be argued that these figures included the cost of work that was left undone, such as weed-mowing, general policing, and similar items. But opposed to such items are those in which failure to do the work in proper season, for example, painting, results in accelerated deterioration that leads to greater expenditures when the job is finally done.

Attention has been directed also to the justification of a lower standard of maintenance on branch lines on which traffic has greatly diminished since 1929, but this condition is offset by the higher standard of maintenance demanded on important main lines by reason of the general stepping up of train speeds as well as the inauguration of streamliner and other super-speed services. However, in taking into account these and the many other factors that have a bearing on the extent of deferred maintenance, it is necessary to keep in mind that the railways entered the depression in the best physical condition in their history. Because of this fact and the marked decline in traffic, the results of neglect were not immediately apparent, but once started they developed at an accelerating rate.

Expenditures during the last five years have failed by a billion dollars to make good the ravages of wear and weather. The trend of train accidents due to inadequate maintenance of tracks and structures points to the need of more intensive upkeep. Expanded programs will require the acquisition of new equipment and appliances.

What is the present status of tie renewals, the outlay for which now represents approximately 14 per cent of the total expenditures for maintenance of way and structures? As shown in the chart on the next page, renewals on Class I railroads declined from 86,829,307 ties in 1920 to 74,679,375 ties in 1929, a conclusive demonstration of the increasing benefits derived by the railroads from the use of treated ties, larger tie plates and other measures designed to increase tie life in track. However, as is also clearly indicated on the chart, the decline in tie renewals since 1929 has been much greater than can be justified on any assumption regarding the influence on average tie life of better preservative treatment and the decline in traffic.

The probable requirements in the years 1930 to 1935, inclusive, based on the downward trend of renewals from 1920 to 1929, inclusive, and assuming that 30 per cent of the renewals are influenced by the volume of traffic, are indicated by the dotted line on the chart. Therefore, the spread between this dotted line and the full line (indicating actual renewals) affords a measure of the deficiencies in replacements during the depression period and indicates an accrued deficiency at the end of 1935 of more than 100 million ties.

The significance of this figure can be demonstrated more effectively by considering renewals in terms of the average per mile of track maintained. Thus, between 1925 and 1929, the renewals per mile ranged from 223 to 236 ties, while from 1932 to 1935, inclusive, they averaged only 118 ties. To absorb the deficiency in renewals, it would be necessary to renew about 93 million ties in each of the next three years, or about 265 ties per mile of track maintained.

Rail Renewals

It is generally conceded that rail renewals are directly proportional to the volume of traffic. However, as shown in the accompanying chart, the renewals during the last five years have declined to a much greater extent than the volume of traffic, as measured by the gross ton-miles. Obviously some weight must be given to the influence of practices adopted by the railroads that have resulted in greater service life of rail. The effect of this influence is evident in the decline in rail renewals during the period from 1923 to 1929, when the volume of traffic was markedly uniform. However, even after making due allowance for this trend and also for the decline in traffic, the evident renewal requirements so far exceed the tonnage actually laid in replacements during the depression years as to indicate a deficiency of more than three million

Behind Maintenance?

A study of the deficiencies in the upkeep of the properties

tons for the Class I railroads at the end of 1935.

Any study of rail renewals is incomplete which does not take into account the influence of the trend toward heavier sections, for the volume of the tonnage of new rail laid is necessarily affected by the relation of the weight of new rail laid to the weight of the released rail. The net effect of changes in weights of rail is indicated by the mileage of track laid with various weights of rail. This is clearly brought out in the chart of miles of track laid with different rail sections, and the table showing the changes in the mileages of track laid with rails weighing 100 to 104 lb. and with rails weighing 105 lb. or more. The increase in the use of heavier rail from 1926 to 1930 was very marked; much less progress has been made since that time.

Increases (or Decreases) in the Miles of Main Tracks Laid With Heavy Rails (Class I Railroads)

	Rails Weighing 100 to 104 lb. Miles	Rails Weighing 105 lb. or More Miles
1926	2,224	4,391
1927	1,902	5,055
1928	1,069	5,506
1929	850	5,511
1930	171	4,331
1931	118*	2,951
1932	195	1,308
1933	2,148*	1,362
1934	2,764	1,746

*Decrease

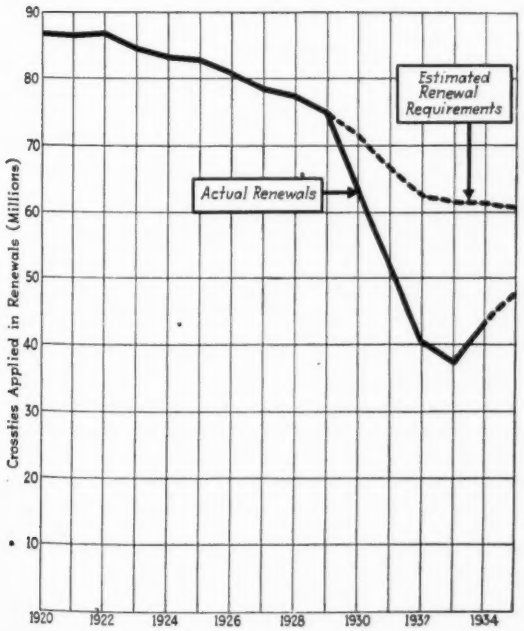
Expenditures for Maintenance of Way and Structures, Class I Railways
(Thousands)

	Average, 1925-1929 (Inclusive)	1930	1931	1932	1933	1934
Superintendence	$ 57,262	$ 57,198	$ 49,324	$ 36,552	$ 31,921	$ 33,347
Roadway Maintenance	83,698	84,794	48,375	32,042	30,026	30,714
Tunnels	2,608	2,087	1,774	1,466	933	1,051
Bridges, Culverts, etc.	43,471	37,612	28,123	19,434	17,627	20,139
Ties	114,859	91,224	72,651	50,294	43,543	50,748
Rails	47,402	34,639	25,960	13,762	14,324	15,418
Other Track Materials	48,354	36,296	26,505	15,726	15,362	18,694
Ballast	19,379	13,262	8,601	4,969	5,814	7,538
Track Laying and Surfacing	211,067	172,136	131,274	83,407	77,025	85,641
Fences and Snow Sheds	5,831	4,494	3,119	2,135	2,047	2,412
Crossings and Signs	13,115	12,632	9,656	6,468	5,969	7,293
Buildings	79,000	63,836	42,539	24,924	24,576	31,448
Water Supply	10,444	8,944	6,299	3,952	3,749	4,441
Tools and Equipment	18,230	16,534	11,834	7,917	8,051	10,666
Injuries	5,907	5,424	3,941	2,811	2,417	2,810
Miscellaneous	88,396	73,145	60,438	45,320	38,902	42,940
Total	$849,021	$705,471	$530,613	$351,179	$322,286	$365,300

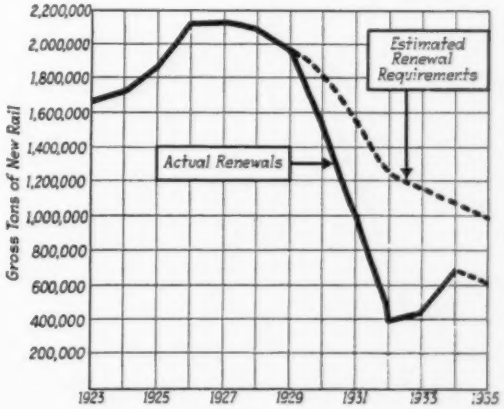
Note: Miscellaneous includes signals and interlocking, all charges for depreciation, and other unclassified items.

The considerations upon which the required weight of rail for a given class of service is determined are obviously far from definite, but it is unthinkable that the future progress in the installation of heavier rail is to be measured by the trend of the last four or five years.

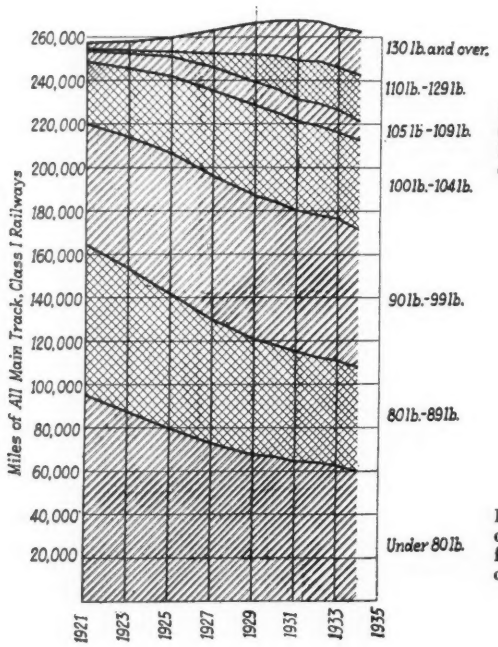
It has been the practice of the railroads to allocate substantially the same proportions of their total expenditures to the various primary accounts from year to year, and they



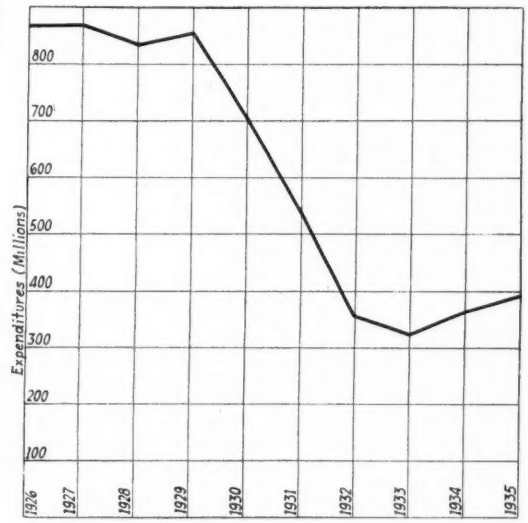
Studies of the Deficiencies in Rail and Crosstie Renewals—Rails on Right, Crossties on Left



continued this policy as they were forced to curtail their budgets with the progress of the depression. There are, however, some interesting exceptions to this rule. Thus, it is no accident that the allotment to ties during 1932-33-34 represented 13.9 per cent of the total, compared with an average of 13.5 per cent during the five years ending with 1929, or that the allotment to bridges was 5.5 per cent compared with a pre-depression average of 5.1 per cent. No elements of the equalling the outlay in 1931 than that for any other primary account. This clearly indicates that track condition at the end of 1932 had reached a state such as to require a marked increase in surfacing operations in the two following years. A similar trend is disclosed with respect to "Other Track Materials." An increase of $3,332,000, or 22 per cent in the outlay for this purpose in 1934, compared with 1933, is definite evidence that the efforts to curtail the purchases of new some consideration of capital expenditures. This is especially true of bridge maintenance because a large part of the expenditure for new bridges is occasioned by the replacement of old structures with new ones of more permanent character. The reason for this is obvious. The railways still have a large mileage of untreated wooden trestles, in addition to many metal bridges that were built at a time when live loads were much lighter than they are today; as a consequence a considerable number of structures come up for renewal—



Left — Chart of Main Tracks Laid with Rail of Different Weights



Right — Graph of Expenditures for Maintenance of Way and Structures

fixed properties exert a greater influence on safety than the tie condition or the state of maintenance of the bridges, and the railroads have accordingly given these two elements of their properties special consideration.

Less Money for Rail

These trends stand out in sharp contrast with that which has prevailed with rail, with respect to which the allotment during 1932-33-34 averaged only 4.2 per cent, compared with 5.6 per cent during the pre-depression period. However, the greatest relative reduction has been made in ballast, the allotment for which amounted to but 1.8 per cent compared with a normal proportion of 2.3 per cent. Here the true picture is set forth more clearly by a comparison of the amounts spent in dollars. Thus, the average outlay in the five years ending in 1929 was $19,379,000, whereas, in 1932 the expenditure was only $4,969,000; but in 1933 this was increased to $5,814,000 and in 1934 to $7,538,000, a figure more nearly materials by the reclamation and repair of old materials would no longer suffice.

As To Buildings

An even more outstanding illustration of this trend is afforded by building maintenance, which reached its lowest level in 1933 with an outlay of $24,576,000 or only 31.1 per cent of the pre-depression average. Expenditures for building repairs for painting, etc., were widely postponed because failure to keep up the condition of buildings rarely introduces any hazard to train operation. On the other hand, neglect of buildings results in accelerated deterioration, that will eventually give rise to far greater expenditures for rehabilitation than would be required if repairs are made currently. That this fact has been recognized is evident from an increase of $6,872,000 or 28 per cent in the outlay for buildings maintenance in 1934.

A discussion of maintenance of way operation is not complete without either in kind or in a more permanent form—every year.

However, as seen in the table of capital and operating charges for bridge work from 1925 to 1934, inclusive, aggregate expenditures for bridges, trestles and culverts decreased to such a marked degree dur-

Expenditures for Bridges, Trestles and Culverts

Year	Capital Charges (A & B Work)	Operating Charges (Maintenance)
1925	$56,467,603	$43,963,000
1926	49,790,907	44,325,000
1927	54,248,941	41,823,000
1928	43,528,431	42,549,000
1929	61,446,119	44,693,000
1930	64,899,656	37,612,000
1931	29,952,801	28,123,000
1932	15,069,634	19,435,000
1933	13,780,295	17,627,000
1934	14,671,734	20,139,000

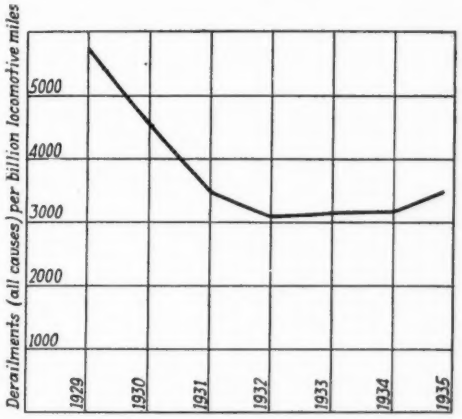
ing the last four years as to leave but one conclusion—that expenditures have been confined so far as is possible to repair work. A study of these figures affords a measure of the dammed-up demand for renewals and replacements.

A somewhat parallel situation pre-

vails in the case of water supply facilities, for as seen in the table of expenditures, there has been a marked reduction in the outlay for improvements as well as for maintenance. There is this difference, however: the replacement of water stations is occasioned only in part by inadequate capacity or deteriorated physical condition. Rather, the large expenditures for new water supply facilities in the past were authorized primarily for the purpose of delivering water of better quality at a lower cost per gallon of water pumped. The figures speak for themselves. In addition to the curtailment of maintenance work by confining attention to those details of the plants that affect reliability of service, and shutting down plants that can be dispensed with during periods of limited demand, the railroads have restricted improvement work largely to the replacement of facilities that could no longer be operated effectively. Here, again, there is ample evidence of the need for large expenditures for both rehabilitation and for new facilities.

Expenditures for Water Supply Facilities

Year	Capital Charges (A & B Work)	Operating Charges (Maintenance)
1925	$6,317,841	$10,832,000
1926	6,551,711	10,892,000
1927	5,082,730	10,416,000
1928	4,054,806	9,898,000
1929	4,890,913	10,182,000
1930	4,362,142	8,944,000
1931	2,860,133	6,299,000
1932	842,752	3,952,000
1933	838,471	3,749,000
1934	824,496	4,441,000



Derailments Have Increased Since the End of 1932

How About Safety?

The presentation of evidence of an enormous accumulation of deferred maintenance almost invariably brings out the rejoinder that the real test of the condition of the properties is their ability to meet the demands of traffic, and that the record speaks for itself. Trains are maintaining a high on-time record on faster schedules than ever before, and with an enviable record for safety of operation.

These statements cannot be contradicted; in fact, they are borne out by the accident reports of the Bureau of Safety of the Interstate Commerce Commission. However, a study of these statistics discloses tendencies that merit attention. Of particular interest to the maintenance officer is the record of train accidents ascribed to defects in or improper maintenance of railway tracks and structures, which is illustrated in the accompanying table. This shows the accident record for the various classifications in the years 1925 to 1934, inclusive, in terms of the number of accidents per billion locomotive miles. This tabulation affords an excellent demonstration of the influence of improvements in the physical properties and the high standard of maintenance effected during the pre-depression period. There was a steady decline in the accidents under all classifications until 1931, 32 or 33, except those due to defects in bridges, trestles and culverts, where the number is so small as to preclude the development of a definite trend. However, a study of the figures for the last four years brings out the fact that the decline in accidents did not continue through these years, but that, on the contrary, in certain of the classifications the number of accidents has shown an upward trend. This is particularly true of the sub-classification "Improper Line and Surface," for which the accident rate for 1933 and 1934 was 31 per cent higher than for 1931 and 1932.

Train Accidents Due to Defects in or Improper Maintenance of Railway Tracks and Structures
(Per Billion Locomotive Miles)

Year	Rails and Rail Joints	Ties and Tie Plates	Frogs and Switches	Bridges, Trestles, Culverts and Tunnels	Miscellaneous	Total	Rail, Broken or Defective	Rail, Spreading Giving Way, etc.	Improper Surface and Line
1925	601	244	316	5.7	687	1,858	401	157	248
1926	575	200	338	5.5	695	1,815	401	135	242
1927	476	136	297	3.5	645	1,550	329	109	277
1928	437	116	249	5.3	483	1,290	301	140	264
1929	396	85	267	4.0	450	1,205	280	94	167
1930	303	56	185	4.5	330	880	229	65	115
1931	262	36	181	2.3	210	690	192	59	64
1932	255	41	139	3.7	175	611	194	51	48
1933	253	37	127	2.9	200	620	189	48	79
1934	255	23	148	4.5	172	602	189	57	77

Derailments

Unfortunately, the classification of train accidents on this basis for 1935 is not yet available, although some measure of the trend during that year is to be had from the record of derailments resulting from all causes.

The Derailment Record

	Derailments All Causes	Loco. Miles Millions	Derailments per Billion Loco. Miles
1929	9,871	1,730	5,710
1930	6,967	1,543	4,510
1931	4,554	1,309	3,475
1932	3,321	1,080	3,075
1933	3,291	1,050	3,130
1934	3,480	1,099	3,165
1935 (10 mos.)	3,227	928	3,480

This is illustrated in the table which shows not only the total number of derailments, but also the derailments per billion locomotive-miles and brings out the fact that the derailment rate has increased since 1932 and that the rate for the first 10 months of 1935 was as high as that for 1931. While the accidents embraced in this record includes those due to defects in equipment and "man failures," as well as defects in tracks and structures, it is reasonable to presume that a part of the pronounced increase in derailments in 1935 must be ascribed to an increase in the effect of defects in the fixed properties.

During the five years 1925-1929, the Class I railways spent an average of $18,230,000 for the repair and replacement of roadway machines, tools and supplies, a sum which is to be compared with an average annual out-

(Continued on page 168)

The Outlook for 1936

Will Expenditures Make Good Current Wear and Tear? Will they Take Up Some of the Accumulated Deficiencies? Thirty two Maintenance Officers Provide the Answer.

THAT more money will be spent for maintenance of way and structures during 1936 is evident from the statements of the chief maintenance officers of 32 of the larger railways in the United States and Canada, embracing 153,000 miles of road. Of these officers 13 anticipated increases in expenditures ranging from "a little" to 20 or 25 per cent. One cites plans for expenditures exceeding those of 1935 by 67 per cent, but the circumstances in this case are clearly not typical. Neither are they in the case of a road that made heavy expenditures last year in preparation for high-speed service, and which expects in consequence, to spend 20 per cent less this year.

Thirteen other roads expect to spend "about the same" amount in 1936 as in 1935, although some of the replies are qualified with the comment that the accuracy of their forecasts will be influenced by the trend of railway traffic. In addition, three railway officers declared that the magnitude of the expenditures they will make depend so directly on the volume of traffic handled that they are unwilling to hazard a guess as to the scope of their maintenance programs in 1936.

What Work?

In addition to a question as to the magnitude of their programs, these maintenance officers were also asked as to the character of the work that would receive major attention this year. The answers on this point covered almost the entire range of the activities of the maintenance of way department, although it was clear that such items as rail, ties, ballast, buildings, etc., are constantly foremost in the minds of these men.

The item of rail was mentioned in 19 of the replies and ignored in 13. Among the 19 that mentioned rail, 11 report that their programs for 1936 will be larger than in 1935, the extent of this increase ranging all the way from 5 to 6 miles to as many as 183 miles. Seven other replies merely mentioned rail as being among the items in their programs, while the replying officer of still another road was in doubt as to the size of his rail program.

Two of the replies make a particular point of rail-end welding as influencing their rail renewal programs. "Rail renewals have been kept at a minimum," writes one of these officers, "but this has been possible because of the extensive laying of 130-lb. rail for more than 10 years, as

well as rail-end welding and the replacement of worn joint bars with reformed bars. Except for the renewal of burned and curve-worn rail, these measures have greatly prolonged the life of rail. But rail renewals cannot be deferred indefinitely. To avoid excessive renewals at a later date, there should be an increase in the renewals at this time to a volume appreciable in excess of the rate for the last few years." Another officer states that whereas his road carried on a large program of rail-end welding last year in addition to a limited amount of rail renewal, the plan will be reversed in 1936; that is, there will be a small amount of welding and a much heavier rail-laying program.

Ties Come First

That the railways have given primary attention to their ties during the depression years and are, therefore, less in arrears here than in almost any other physical feature of the property is evident from the replies to the questionnaire. Twenty-four do not mention ties at all, three refer to them as having an important place in the program, one states that less ties will be inserted, three will use more ties, while one reports a larger appropriation to cover the use of a larger proportion of hardwood ties.

The need for more ballast is evidently far more urgent, 10 officers referring specifically to ballast programs, in addition to 3 others who mentioned expanded surfacing operations. Ditching and drainage work is cited by two roads; bank widening by two others. Six refer to expanding painting programs, and two railways report plans for more bridge maintenance as well as bridge replacements. The reason, as given by the chief engineer of one of these roads, is that "some temporary bridges have been carried to a point that they must now be replaced and, in addition, we have a program of replacing light steel bridges with heavier structures on account of the contemplated acquisition of heavy freight power."

More Labor

Five of the roads represented expect to increase their labor allotment in 1936, one of the replies making particular reference to larger section forces. However, in the one instance in which the proportions are given, the increase in the material allotment is greater than that for labor. On this road, which has increased its maintenance budget 25 per cent, the increase in materials will be about one-third and in labor about one-sixth. The reply from one road calls attention to the fact that it has been necessary to increase the labor allotment to compensate for the restoration of wage rates.

Was It Enough?

Has your rate of expenditure during the last three or four years been sufficient to maintain your properties indefinitely? This question was answered in the affirmative by only nine officers, but of these, two qualified their answers with the words, "for the present volume of traffic," while another states that "we have not lost much ground; in fact, we have improved in some respects." The attitude of some of the maintenance officers concerning the relation of deferred maintenance to volume of traffic is rather effectively expressed by one of them as follows:

"The rate of expenditure during the past few years has been sufficient to maintain roadway, track structure, bridges, signals and interlocking plants in a satisfactory condition to take care of the amount of traffic handled with an adequate margin of safety. And with the same amount of traffic and the same rate of expenditure, assuming no substantial change in rates of pay or cost of materials, we could continue to maintain our property in a fairly satisfactory condition for a number of years. We are most deficient in such work as repairing and painting roadway buildings, station and office buildings, and shop buildings, the maintenance of fencing and signs, the eradication of vegetation and general cleaning-up work, and also to some extent in the replacement of ballast, out-of-face resurfacing and reballasting, the repair and replacement of water tanks, stock pens, platforms, driveways, etc."

Say It Was Not

All the others report varying degrees of deferred maintenance, from those who state that the expenditures have been "barely sufficient" or "possibly not sufficient" to those that admit of an appreciable volume of deficiency in maintenance. Others say that the outlay has been adequate for the present volume of traffic but will have to be increased as traffic increases, although the tone of some of these remarks leaves doubt as to whether the volume of traffic or the needs of the property is the criterion. The latter certainly determines how much is actually appropriated, as was pointed out in many of the replies, but the impression is also gained from the replies that the same consideration should be applied in comparing the net result of the expenditures of recent years with that produced by the more generous outlays during the "twenties." In other words, there is a tendency to use the word "normal" as applied to the expenditures if they bear the accepted fixed ratio to the current earnings, whereas, in considering the physical condition of the property as influenced by the volume of the expenditures made, expenditures can be deemed "normal" only if they have been adequate to keep up with the current rate of wear and tear.

"Safety of Operation"

A number of the replies report adequate maintenance except as to certain items, which will be discussed later. One road reports adequate expenditures in 1934-35 but insufficient outlays in 1932-33. Others express a less sanguine outlook concerning the condition of their properties. "We have spent our money primarily for the purpose of insuring safety of operation," is typical of the remarks by this group. Another says, "The rate of expenditure during the last three or four years would maintain the property indefinitely, with the exception of rail and other track material, but the property would not be maintained to our usual standard."

In answers to an inquiry as to the particular elements of the property that are suffering from inadequate maintenance, the majority of the replies centered on two track items as well as two relating to structures, namely, rail and ballast, and building repairs and painting. Other track items, in the order of their importance in this connection, are: Ties, roadbed, other track materials, ditching and drainage, right-of-way, and line and surface.

If there is any phase of undermaintenance with respect to which there seems to be rather general agreement, it is that the repair and painting of buildings have generally been neglected. "We have been deficient in painting minor repairs to buildings, etc."—"Our expenditures have been deficient in the painting of buildings, the care of station properties, the right-of-way and similar items not essential to the safety of the property," are typical comments. On the other hand, only one or two of the officers indicate any concern relative to the adequacy of expenditure for bridge maintenance. In fact, even references to deferred painting are usually confined to comments on the deferred maintenance of buildings. The following comment is typical: "There has been some deferment of

the painting of buildings, signs, etc.—our bridge painting has been kept up in a satisfactory condition."

In commenting on deficiencies in maintenance, the officer of one railroad refers to the deferred upkeep on service facilities to industries, such as quarries and mines, that have not been needed during the depression but that will require heavy expenditures to put them in condition for use when the business of these industries is resumed. Another officer states that, whereas the main tracks have been kept in a reasonably good condition, his road has been most deficient in keeping up the condition of rails and ties in yards.

Under still another heading must be placed the statements made by those officers who insist that they are not confronted with any deferred maintenance since, obviously, in such cases, no item is deserving of particular attention. However, even in the case of the replies from men who state that a considerable amount of deferred maintenance has accrued on their properties some state that the deterioration is general, or, as it has been put by one officer, "There is no marked deficiency in any one particular thing. Probably some increase in rail renewals or the application of ballast would receive first attention if expenditures were increased, followed by an increase in tie renewals and in ditching, bank widening and weed control."

Making It Up

A study of deferred maintenance together with an effort to forecast the volume of work to be done in 1936, naturally raises the question as to the extent to which the program for the current year will be effective in overcoming the deficiencies of past years. Obviously, those maintenance officers who contend that little or no deferred maintenance prevails on the properties under their charge, replied that there was no work to be made up. In the opinion of one of these men, his road will be able to maintain its present high standard, and, in addition, affect an appreciable improvement on certain lines to take care of traffic at higher speeds. As to the others, the answers vary widely. Ten roads anticipate that their expenditures in 1936 will be no more than sufficient to take care of the current wear and tear. In fact, it is the opinion of one railroad officer that it will be necessary to increase the expenditures for maintenance of way and structures 50 per cent over the present appropriation for the next five years in order to restore his property to the condition that prevailed in 1929. In the opinion of 10 maintenance officers, their programs for 1936 will result in some improvement in the average condition. According to one chief engineer, his railroad will affect an improvement in ties, ballast and bridges. Another anticipates a marked betterment in his average rail condition, while still another contends that the work in 1936 will result in the complete elimination of deferred renewals of rail.

Some Comments

Because of their interest, excerpts of the replies of a number of railway officers are reproduced below:

"We are hopeful that some little progress will be made in 1936 in catching up on some of the accumulation of under maintenance, particularly in building and structure repairs and painting, and also to some extent in reballasting work. Preferential attention will be given to needed resurfacing and reballasting work on high-speed main tracks."

"We hope that we can more than make good the current wear and tear this year by increasing our rail program, bank widening and ballast replenishing."

"If we lay the sixty track miles of rail that is planned for this year we will more than make good current wear and tear, and our railroads will be in a great deal better condition at the end of the year than it was at the beginning."

"We anticipate that our program for 1936 will be more than adequate to meet current wear and tear. We caught up some in 1935 and if business is better we will catch up more in 1936."

"We will probably not be able to make good the wear and tear that has occurred during the past four to five years, to the extent desired. Our efforts will be directed to restoring as much of the deficiency as the improvement in business and the resulting larger maintenance allowances will permit."

"We will catch up materially on our accumulation of under-maintenance on ballast, and will also make some gain on the comparatively limited deferred tie renewal. These activities will receive our first attention. We will also catch up to a considerable extent on the painting of buildings, signs, etc., on which we have some deferment. Our bridge painting has been kept up in satisfactory condition."

It is evident from this survey that the maintenance programs for 1936 will be generally larger than they were in 1935. While the increases will vary on different roads, it is certain that increased revenues will result in a stepping up of the activities on most railways.

The reason for this is apparent in the replies received to the question on the extent of the deferred maintenance. Except on those roads that have been in a position to continue their maintenance programs on a generous scale during the depression years, there has been a growing appreciation among maintenance officers of the magnitude of the deficiencies in upkeep that have occurred since 1930. According to a number of the statements, these deficiencies have not yet resulted in any appreciable loss of effectiveness of the properties as instrumentalities for the conduct of transportation, but it is equally apparent that little reserve strength remains and that the present level of expenditures is no more than sufficient to compensate for current wear and tear.

Thoroughly cognizant of this state of affairs, most maintenance officers are anxious to make at least a minimum of progress in "catching up" on the work that has been left undone. The indications are that the programs for 1936 will permit of some progress in this direction. On some roads the results will be marked, but on the majority they will represent no more than an encouraging start on the vast project for rehabilitation that must be carried out eventually.

Marine Borers Cause Alarm

THE increase in the destruction of wooden structures in New England waters by marine borers has become so alarming that an investigation started in 1934 is being continued on an enlarged scope this year. Teredo navalis has appeared in waters that were previously immune and are causing serious destruction in dolphins and piling. Attack by limnoria is now as severe in New England waters as in many parts of the tropics.

The reason for this increased activity has not been discovered, but it is believed that some condition is causing a northward migration of marine life. Testing grounds are being established, where every possible means of protecting marine structures may be tested by exposure to severe attack of the marine borers.

The investigation is being conducted by the New England Committee on Marine Piling Investigation, sponsored largely by the railways.

High Standards of Maintenance Call for Modern Work Equipment

Work Equipment—

Is it Adequate for Today's Programs?

For more than six years purchases of work equipment have been kept to the minimum, while much of that in service has been used to the maximum. This article gives the results of a survey of 32 representative roads aggregating 153,000 miles of line, showing the present status of this equipment, where deficiencies exist, what the prospects are for replacements and additions, as well as needs which are as yet unfilled by reason of the equipment not being available.

IS THE work equipment now in service adequate to meet the needs of today's maintenance? Is it modern? Is it worn out? To what extent does it require replenishment? Adding to? How large is the present investment? In other words, what is the status of work equipment today? In the belief that these are questions of wide interest and that information concerning the general situation with respect to work equipment will be helpful to maintenance officer, a number of chief engineers and engineers maintenance of way were invited to discuss the subject, and 32 of them, representing 153,000 miles of lines in every section of the United States and Canada have done so in detail for their own roads.

In any discussion of this subject it is obvious that the amount of equipment in service, particularly for certain classes of work, is of first importance to those officers who are responsible for maintenance. Any shortage of needed units compels resort, in whole or in part, to hand methods at a time when the effectiveness of maintenance methods should be at its maximum.

The question regarding the adequacy of present equipment brought out a wide variety of answers. In some cases, the officers discussing this phase of the subject replied that they do not have enough units of any type and that there is a complete lack of some types. About an equal number reported that they have all that they need of certain kinds of machines and tools, but that they are seriously short of or do not possess other kinds which they are in need of. A few reported that they have all of the work equipment of all kinds that they require and that they do not feel the need for a larger number of units of any type.

Are they Sufficient?

Typical of the first group, one chief engineer stated that "we are not adequately supplied with work equipment; in fact, we probably have less of it than any road of our size." Another said that "we are not adequately supplied, but what we have is modern." In the second group, the engineer maintenance of way of a road which is notable for its extensive use of roadway machines and tools, stated that "there is a definite shortage which we expect to decrease some-

what through the purchase of additional equipment this year." A second officer in this group reported that "there are a number of types which we need badly and which we would like to obtain this year."

It was noticeable that a number of those in the third group based their opinion that they now have an adequate amount of work equipment on the magnitude of their maintenance operations during the last four or five years. Several of these officers added, that any marked increase in maintenance of way expenditures will necessitate the purchase of additional equipment to insure the requisite economy in these expenditures.

In support of this latter position, the chief engineer of one of the larger roads said that "during the last four or five years we have been adequately supplied, but additional equipment will be needed when we enlarge our maintenance program." A second chief engineer remarked that "since our maintenance program, especially the application of major materials, is still on a reduced basis, we have enough work equipment," while a third observed that "we have enough for our ordinary needs only."

Antiquated Hoisting Equipment Is Still in Service

End of Service Life

Since the railways have purchased so little work equipment since January 1, 1930, it becomes particularly pertinent to inquire whether the units now in service are approaching the end of their service life and how many of them can be classed as modern. From the information given, it is obvious that much of the equipment now in service is not modern, even when the most liberal interpretation is placed on the term. Many of the officers stated frankly that this is so, while a few reported that through a policy of retirement and replacement as the units become worn out, they have kept theirs up to date. A few also estimated that from 10 to 50 per cent of what they are using is modern and that the remainder is in various stages of obsolescence.

In the same way, there is a wide diversity in the condition of the equipment. Many of the machines have been used almost continuously for the last six years, while others have been used to the limit of their capacity as they were required. As a matter of fact, not a few of the units in service at the beginning of the depression were relatively old at that time, and some of them have been kept in service since then to avoid the purchase of new equipment. On the other hand, in the years immediately preceding 1930, work equipment was being purchased on a large scale and at a rate never before equalled. For this reason, six years ago a considerable portion of the total equipment then in use was new.

What Condition?

During the six years intervening, some types have been in almost continuous use, while others have been used intensively as the need arose. In other cases, owing to curtailment of maintenance programs, certain types have been used only occasionally. Again, the standards for maintaining this equipment during these years have varied widely between roads, as have the practices relating to retirement and replacement. For these reasons, as between types of equipment and even within individual types, as well as between roads, there is a wide diversity in the physical condition of the work equipment in service today.

Furthermore, in some cases, the number of units available, compared with the demand for their use, has been a factor in determining whether the machines have been kept in first class repair or have been allowed to wear out before their normal service life has expired. It is customary to send work equipment to the shop for general repairs at the end of the season. Yet as a unit grows older, the difficulty of keeping it in good operating condition through repairs in the field increases, regardless of the standards of maintenance. For this reason, where there is an insufficient number of units to meet all of the demands of maintenance, the unit is quite likely to become worn out much sooner than if sufficient equipment is available to allow it to be taken out of service temporarily during the working season.

That this is the situation on not a few roads, even on some upon which the standards for maintaining equipment are relatively high, is apparent from the discussions. The chief engineer of an importnat western road said frankly that "our work equipment is old and is approaching the end of its service life." An officer of another large road stated that "while we have ample equipment to meet our immediate needs, some of it is approaching the end of its service life, and some of it is not wholly modern." A third officer, well known for his progressive practices, observed that "some of our work equipment is now reaching the end of its service life and little of it is modern."

A chief engineer who has given much study to the economies which can be effected through the use of work equipment, stated that "some of our units are approaching the end of their service life. We have many modern machines in service, but we also have some still in use which are obsolete as to type." The engineer maintenance of way of another large road observed that "none of our work equipment is modern, but we can probably get two to three more years of service out of it, except motor cars which are all in bad shape."

Obsolescence

The engineer maintenance of way of still another road, which was not only liberal in its purchases of work equipment prior to the onset of the depression but continued to be so for some time thereafter, stated that "much of our equipment was purchased several years ago, for which reason some of it is now approaching obsolescence. The condition of those units now in service is generally good, because we have followed the practice of retiring them to get them out of the accounts as soon as their service life is ended. As a result, we have practically no unserviceable equipment on hand." Three other officers stated, respectively, that "we are ade-

quately supplied and our equipment is still modern enough for maintenance work;" "we have plenty of equipment and are maintaining it in fair condition, and while it is not modern, it is answering our purpose;" and "we are not very well equipped and some of the units we have are out of date."

According to their officers, a few roads have succeeded in keeping their work equipment up to date and in good physical condition during the depression years. Typical of the comments from these roads was that of an engineer maintenance of way that "in general, our equipment has been kept up to date with respect to being modern. All equipment that have become obsolete or worn out has been retired." "We do not have enough, but what we have is modern" was the statement of another officer. In like vein, another observed that "most of what we have is modern and is in satisfactory condition for service."

From a road which has probably used its work equipment more intensively than most, came this comment, "We are adequately supplied, except for ballast cars. In general, our work equipment, including all types of roadway machines, is well maintained and reasonably modern. During the period of the depression we have increased rather than decreased our expenditures for maintaining all types of work equipment and for the most part all of our units have been kept in service continuously."

Deficiency

Whether the work equipment now owned and in service on the railways is adequate to meet their needs has been discussed in somewhat general terms. To develop this information somewhat more fully, inquiry was made as to the specific types in which a deficiency exists. The discussions of this phase of the subject were somewhat startling in their revelations, since practically every type of equipment now available for roadway, bridge and building work was mentioned. Some officers gave a long list, while others confined their statement to one or two types. Taken in the aggregate, the total number of units which these officers believe they can use to advantage is surprisingly large.

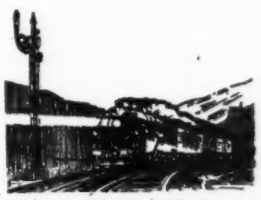
It was interesting to note that some even of those who had said previously that they have sufficient equipment to fill their requirements mentioned a number of types of which they can use additional units to advantage. Several others who had also stated that they now have sufficient work equipment but mentioned types in which they are deficient, qualified this latter statement by saying that while they now have enough work equipment, some of it is practically obsolete and so near the end of its service life that it will be more economical to retire it and replace it with more modern designs.

Cranes Needed

Of the more than 40 types of work equipment, not including small power tools, which were mentioned as being needed, cranes, including locomotive, rail-laying and off-rail (crawler mounted) designs, stood first on the list, 21 officers stating that they are deficient in this equipment. Of these, 12 expressed a need for rail cranes, most of them preferring the full-revolving type which can be used on other work when not engaged in laying rail. Those who feel a need for crawler-mounted equipment expressed a preference for the convertible design which can be used also as a dragline for cleaning ditches.

As might be expected, tie tampers came next, 14 of the roads being short on this equipment, while several others said that any relaxation of the present restrictions on maintenance will bring them into the market for this equipment. In addition, a number said that although they have sufficient units for present needs, some of their machines are at the end of their service life and must be replaced. Substantially all of the replies indicated that tie tamping equipment is being used intensively and that some of it has now gone beyond its economical service life, particularly in view of the added efficiency of the newer designs.

Indicating a wider interest in the substitution of power machines for hand work in routine maintenance, fully as many officers are feeling the need for power bolt tighteners. Few of the roads in this list now have equipment of this type and others have only one or two units. Yet these officers are so well convinced of the advantages of power operation in the tightening of bolts that they have included from one to eight of these machines in their current budgets.



While none of the discussions indicated a deficiency in motor cars, a majority of the officers said either directly or indirectly that in the main those they do have are either obsolete or worn out, or both. One of the features mentioned most often as indicating a real need for new motor-car equipment was that the cars now in use are too heavy to be handled by the present section gangs, for which reason they must be provided with lighter cars.

It is common knowledge that on most roads new applications of ballast have been held to the minimum during the last six years, and that on some no new ballast has been used. Again, while some roads have been more active in cleaning ballast than formerly, to offset the reduced amount of new ballast and general surfacing, others have neglected or have lacked the equipment to do this, except on a minor scale. This situation was reflected by the number of officers who said that they are short of ballast cars, ballast-cleaning and ballast-cribbing equipment, and that these devices are sorely needed. In fact, these types were mentioned more often than any of the others, except cranes.

For some time motor trucks have been used in a small way, particularly around terminals and in suburban territory where the intervals between trains is short, for the delivery of track and other maintenance of way materials. More recently, on certain roads, this method of delivering material has been pushed farther afield, notably on the New Haven, which is transporting both men and material by this means on all parts of its lines. Indicating that other roads are considering this method, several officers said that they are feeling the need for motor trucks, and one expressed the need for rail-highway cars, as a part of their work equipment.

Want Other Types

Similarly a number of officers are hoping to obtain crawler-mounted power shovels, ditchers, draglines, tractors and other off-track machines, which will make them independent of work trains and enable them to do work which they are now compelled to do by contract. Mowing the right of way, plowing fire guards and removing snow were mentioned, particularly as tasks for which tractors and incidental equipment are needed. Air-dump cars were also mentioned by several officers as being needed in connection with ditching equipment. Air

compressors and generator sets, with either rail or crawler mountings, are items for which there is a particular need for doing work other than tamping ties or welding. Most of those who spoke of these machines need them for operating small tools in connection with bridge and building work.

Rail Laying

Laying rail has almost ceased to be a hand operation, although many of the tasks incidental to this work are still being performed by hand, to a greater degree on some roads than on others. For this reason, despite the large number of units for use in laying rail which were purchased prior to 1930 and although, relatively, a considerable number have been purchased since that time, there is a wellnigh universal shortage in adzing machines, bolt tighteners, spike pullers and spike drivers. Only a few of the officers said that their roads have sufficient equipment of these types and a number reported that they are in extreme need of all of them.

Increased Demand for Tampers

Owing to the marked reduction in rail renewals which has characterized the period since January 1, 1930, the need for rail-end welding has increased by leaps and bounds, on most roads far exceeding the capacity of the equipment provided for this service. It is not surprising, therefore, that many officers, in discussing this question included welding and grinding equipment among their most vital needs.

Keeping the track free from vegetation as the ballast has gone from year to year without renewal and keeping the right of way cut with reduced forces, have become more and more of a problem for maintenance officers. Six years ago most of the roads were fairly well equipped with weed-destroying machines of various types, although only a few had all they required. This equipment has been used intensively during the intervening years. Much of it had already been in service for a number of years and owing to the improvements which have been made in design, substantially all of it is now obsolete and a relatively large percentage is worn out. For these reasons, more than a few roads advised that they are in need of mowers, discers and weed burners for replacement purposes, while they also need additional units.

This by no means exhausts the list of equipment which the roads need to make up their deficiencies and for replacement purposes. While practically all of the officers expressed a need for additional units, many of them placed as much stress on replacing those that are worn out and obsolete as on acquiring additional equipment, on the ground that the older machines are uneconomical as compared with those of more modern design, while their physical condition, because of their age, increases the unfavorableness of the comparison.

What Will Be Done?

It is one thing to feel a need and another to do something about it. For this reason, the officers who were invited to discuss these matters were requested to give specific information as to what equipment, if any, they expect to purchase this year. Surprisingly, every item except two, ballast cars and steam derricks, which have been mentioned in the foregoing as being needed, have been included in budgets that are already authorized or upon which favorable action is expected.

Obviously, the number of units to be purchased is far less than those needed, including all types. While a few roads do not expect to replace or add to their present equipment, others are planning to do so on a relatively large scale. As an example, one of the roads which has kept its work equipment up to date by retirements and replacements, will purchase 64 units including 10 types. The engineer maintenance of way of another road which is far from being as well equipped will buy only slightly fewer units of as many types, and a third will spend as much or more in the purchase of eight types.

Motor cars lead in the total number of units to be purchased, and these are followed in order by tie-tamping outfits and power bolt tighteners. Substantially every road expects to buy some motor cars, several specifying 40 or more. Tie tampers range from a single unit to as many as 22 for individual roads, with several at or near the upper limit. Not all of the roads specified the number of bolt tighteners they are buying, but those that did included from two to eight units, while others said indefinitely "several" or "a number."

Cranes

In view of the widely expressed need for cranes of various types, it is not surprising that a considerable number of roads have included this equipment in their current budgets. While the number which has done this is equal to that of those who are expecting to buy motor cars, tie tamping outfits and bolt tighteners, the number of units is considerably less than for any of these three types, since the individual roads plan on only one and two cranes, compared with more units of the other types.

Mention has been made of the emphasis placed on off-rail equipment by certain maintenance officers. This view is reflected in the fact that nine of them are planning to purchase one or more crawler-mounted shovels, draglines and tractors, some of which are already authorized. Two others expressed the hope that they will be able to get one or two of these units, but were not yet certain that they will be authorized.

Obviously, a complete list of all of the types that will be purchased within the next few months is too long to be given in detail. While the number of roads and the number of units to be purchased varies for each type, some roads are expecting to purchase several units of some types and none of others. Other roads plan to purchase at least one of each of the fol-

lowing types and as many as four of some: Weed burners, mowers, discers, welding outfits, grinders, ballast cleaners, cribbing machines, spike pullers and adzing machines. Several added spike drivers, paint sprayers, generators, air compressors, concrete mixers, motor trucks, pile drivers, and a wide variety of small power tools, as well as a number of miscellaneous items, including a rail-highway motor car.

Start Spray Painting

Heretofore, in general, spray painting has made little headway in the maintenance of way department, although it has been practiced with success by the mechanical department for a number of years. During the last six years, owing to limited appropriations, painting has been almost wholly neglected. At the beginning of this period, it was recognized that it could be eliminated temporarily without causing damage to the structures. Several officers observed, however, that the time has now arrived when further neglect of this feature of maintenance cannot longer be allowed without creating serious deterioration.

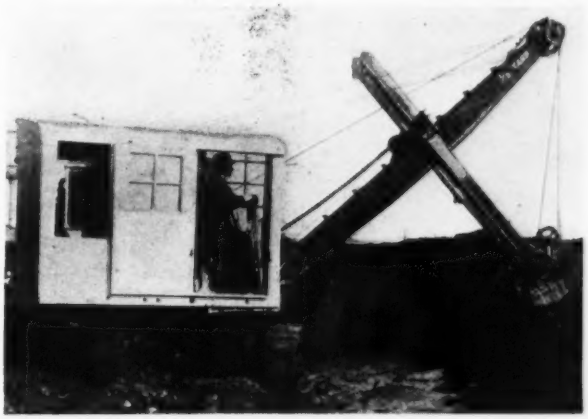
As a result, several of the roads have included paint-spraying equipment in their budgets and this year will apply their paint in this manner for the first time. As one officer explained, "we are far behind in our painting and must do so much of it to prevent severe damage to our structures, particularly bridges, that we cannot hope to make much of an impression with the forces at our command unless we change our methods. I am, therefore, ordering several spraying outfits."

According to the information given, bolt tighteners, more than any other type of equipment, will be used for the first time this year. While a number of roads expect to buy additional units, others do not now have machines of this type, but say that they are including them to conserve their labor for other purposes.

Small tie-tamping outfits of the two and four-tool designs are to be tried out on several roads this year. As one officer expressed it, "We have long desired to put mechanical tamping tools in our section gangs, but because of the size and cost of those available, we could not afford to do so. We hope that these small outfits will demonstrate that they are adapted for this service."

Other equipment which will be used for the first time on some of the roads from which information was received include rail cranes; crawler cranes, shovels and draglines, some of these units being completely convertible; tractors; ballast cleaners and cribbing machines; a bulldozer; and a sewer-cleaning unit.

As a different approach to an understanding of the amount of work equipment in service on the railways, the officers of these roads were requested to state the magnitude of their present investment in this equipment. Three of the large roads and six of the smaller ones replied that they did not have the figures readily available. The remaining 22 gave figures ranging from $36,000 for one small and poorly-equipped road to $5,450,000 for one of the larger ones which is well supplied with work equipment. On the other hand, only 7 of these roads reported below $750,000, 3 between $750,000 and $1,000,000 and 12 range above $1,000,000, of which 2 rank above $5,000,000. It is of interest that the total investment in work equipment of these 22 roads is more than $31,500,000.



More Cranes and Shovels Are Needed

Now Available

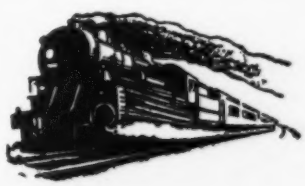
Work equipment is now available for a wide variety of tasks, some types of which can be obtained in a number of designs. Inquiry was made to determine what tasks remain for which such equipment is not yet available or has not yet been developed to the point where it is satisfactory for the purpose intended, and how much demand there is for machines for these purposes.

In the replies, four classes of machines were mentioned. The one referred to most often is a device for removing and inserting ties in the track without disturbing the line and surface. As one officers put it, "Ties constitute the largest single item in maintenance and the labor cost is high, so that any satisfactory means whereby we could reduce this expense would be of great benefit."

Reduced ballast renewal has brought an insistent demand for more satisfactory methods of cleaning ballast than are now open to many roads, particularly the smaller ones. The chief engineer of one of these roads observed that "some of the larger roads can doubtless demonstrate sufficient economy to warrant the use of large and expensive machines, but it is out of the question with us. What I need is a small and inexpensive machine for cleaning ballast, the carrying and maintenance charges on which will be within reason."

For the same reason, cleaning the cribs has assumed greater importance than formerly, when it was customary to use the ballast from the cribs for raising the track. A large number of maintenance officers are, therefore, seeking a satisfactory machine for cleaning the cribs.

One further comment related to modification of the equipment now available, to reduce weight, give greater speed of operation, higher efficiency and lower operating costs. Most officers are aware that considerable progress has already been made along these lines during recent years, but they do not believe there has been enough. What they want is lighter, but sturdy, machines with self-contained power units, which are rapid in action and dependable with respect to broken parts. They recognize that in large measure they must look to the manufacturer for these improvements, and they feel assured that they can depend on him to make them.



Is There a Dollar Value in Modern Equipment?

An example of the dollar value of discarding obsolete equipment and substituting therefor the latest models where they are able to demonstrate superior operation or higher efficiency is illustrated by comparing the results obtained by two rail gangs on the Chicago & North Western, which laid rail under almost identical conditions. By using the latest equipment this road was able to increase its output per man employed by 25 per cent, as compared with a gang which, eight years before, was equipped with the latest machines then available.

IT IS a trite saying that maintenance practices have developed so rapidly in recent years that those of yesterday are outmoded today and that those of today will, in part at least, be obsolete tomorrow. It is rarely, however, that opportunity is afforded for a clear-cut comparison between the methods of today and those of only a few years ago. Such an opportunity was afforded during the last summer to compare the methods practiced in 1927 in laying rail with those followed today on the same road under almost identical conditions. In both years the rail was laid on the same line, although not on the same section of the line, which is double track; the weight of the new rail was not greatly different; and in both years the rail gangs were fully mechanized with up-to-date power equipment and tools.

Power Equipment

Fully as interesting as the difference in methods, the comparison brings out quite clearly the advance which has been made in the design of power equipment for laying rails. Some machines which were not available at the earlier date have been developed in the meanwhile, others have been improved, and still others have failed to meet the exacting requirements of effectiveness or economy which the laying of rail demands.

For many years it has been the policy of the Chicago & North Western to employ power machines and tools in track maintenance where this could be done effectively and economically. In pursuance of this policy it has kept abreast of the developments in the power-equipment field, although obviously, in view of the difficult economic conditions of the last few years, not all of its machines today are the latest models. On the other hand, as a result of this policy, its rail gangs, both in 1927 and in 1935 were fully mechanized with the latest equipment of those dates, and the methods followed by the rail gangs were equally up to date. For these reasons, it is possible to compare the methods and equipment used in 1935 with those of eight years earlier.

The work in question was carried out on the Chicago-Omaha line of the North Western by specially-organized gangs which moved from division to division as required by the rail program for the year. While on any division, however, the gang was under the direct supervision of and reported to the roadmaster. In neither year was any effort made to make or break records in laying rail. Rather, it was believed that better ultimate results would be obtained by a balance of every operation, which would give steady, orderly progress, with every item of work completed up to the point of closure every night.

Traffic Diverted

To permit uninterrupted use of the machines and at the same time reduce delays to traffic to the minimum, in both 1927 and 1935 traffic was diverted during working hours from the track to be relaid. To accomplish this, temporary crossovers were installed at convenient intervals, generally to provide for either two or more

days' work, the location of the crossovers and their spacing depending on grade conditions, the proximity of stations and the probable frequency of train meets.

As a further measure to eliminate delays to traffic, operators were placed at each of the temporary crossovers and provision was made so that they were in constant touch with the district dispatcher. In addition, in 1927, a dispatcher was assigned locally to handle train movements over the stretch of single track. By careful planning on the part of the local and district dispatchers, serious delays to trains were avoided and all delays were reduced to the minimum.

Owing to the fewer trains in 1935, and to the further fact that in the territory where the rail was being laid all but four important passenger trains were scheduled to pass outside of working hours, a local dispatcher was not assigned. Instead, the operators worked directly with the district dispatcher, and the assistant superintendent of the division was detailed to maintain general supervision over all train movements, including those of the work train employed in connection with the rail renewal.

In both years, at the end of the day every detail of the work back of the point of closure was completed and the track was in condition for double-track operation. This included the bonding for the track circuits and the picking up of the old rail and other materials, so that each morning the gangs were able to start with a clean slate. As a further indication of the similarity of the conditions in the two years, in 1927, 100-lb. rail was replaced with 110-lb. rail. In 1935 100-lb. rail was replaced with 112-lb. rail.

Organization

In general outline, the gang organization was the same in both years. There were marked differences, however, in the internal details of the two organizations, brought about largely by the difference in the number and types of power equipment, whereby it was possible to reduce the number of men in the gang from 185 to 120. The sequence of the various operations was substantially the same in both years, the few minor variations that were noted being the result of these differences in the power units. For this reason, the sequence and methods followed in 1935 will be given and compared with 1927 where these differences were of consequence.

New tie plates were installed in both years because the bases of the old and new rail were not the same width. For this reason, in both years,

Two Machines to Pull the Spikes, Each Manned by Three Men, Led the Operation

One Nut Stripper Was Able to Keep Up with the Work

The Rails Were Thrown Out by Hand by Two Men with Lining Bars

Two Men Set Tie Plugs and Two Men Drove Them Down

A Battery of Adzing Machines Prepared the Ties for the Tie Plates

Placing the Tie Plates

Dropping the Rail into Place

all spikes were pulled and the ties were adzed. In both years the joints were stripped while the rail was still in the track and the rails were thrown out individually.

Prior to the arrival of the gang the rail and turnout material was distributed on the ground, but the track fastenings and other small material were distributed daily immediately ahead of the gang by the work train. When this distribution was completed, the train dropped back to load the old rail and materials and do other incidental work.

A general foreman and three assistant foremen were in charge of the work in 1927. In the belief that more intensive supervision of this important work is warranted, two foremen were added to the force in 1935, although the gang was smaller, while a signal foreman and one assistant foreman had charge of the application of the insulated joints and the bonding.

Preparatory Work

Preceding the main units, 1 man distributed tie plugs, 2 men placed the new tie plates in the center of the track, 1 signal man clipped the bond wires and 1 man removed the anti-creepers. Leading the gang, 2 Nordberg spike pullers, 3 men with each machine, pulled the spikes. Owing to the relative position of the spikes and bolts in the joints, not all of the joint spikes could be pulled with the machines, for which reason two men with claw bars followed the spike pullers to pull those at the joints and any others that had been missed, such as badly throat-cut or otherwise defective spikes.

These 9 men, 1 removing anti-creepers and 8 pulling spikes, compare with 2 men removing anti-creepers and 42 men pulling spikes in 1927, at which time the latter operation was performed by hand, since acceptable equipment was not then available for this work. The use of these two power spike pullers thus resulted in a reduction of 34 men in this operation alone.

Following the spike pullers, 1 Nordberg nut stripper, manned by 2 men, turned the nuts off of the bolts. While this machine has sufficient torque to break a bolt in case the nut is refractory, to avoid loss of time frozen nuts and nuts with rounded corners were left to be burned off by a torchman who followed close behind with an oxy-acetylene cutting torch. Immediately behind the torchman 1 man removed the angle bars.

In 1927, the nut stripper in use did not have sufficient power to start the nuts quickly, for which reason 4 men were assigned to start them with hand

wrenches, after which they were run off with the power machine. The force employed at that time consisted, in addition to these 4 men, of 1 operator, 2 strippers, 1 torchman and 1 helper and 2 men removing angle bars, a total of 11 men, as compared with 4 in 1935, a reduction of 7 men, 5 of whom are accounted for by the use of more modern equipment.

Lining Out Rail

Setting out the old rail was a machine operation in 1927, which required 1 operator, 1 tongman and 2 men to guide the rail. This is a case, however, where it has been found that the work can be done as effectively by hand, since the individual rails can easily be thrown out by 2 men with lining bars, a reduction of 2 men, as was being done this year. There is considerable advantage in eliminating large power units from a busy gang unless they can do the work more effectively or cheaper than it can be done by hand. In this case, there was a further advantage in the fact that the crane was released for work elsewhere.

As soon as the rail was out of the way, 2 men threw the old spikes and tie plates out on the shoulder where they were convenient for loading on the work train. They were followed by 2 men with a punch and sledge, who drove down any spike stubs that were left. Next came 2 men setting tie plugs and 2 men driving them down. Following this, 3 men leveled the ballast in the cribs to clear the rotating adzing heads and swept the ballast and grit from the top of the ties.

Three Nordberg adzers, each of which required two men, then adzed the ties. The practice followed was for the first machine to make a rough initial cut of sufficient depth to remove all loose, decayed and splintered wood. The second one then made a major cut in the sound wood and the third made the finishing cut, each of the machines was thus used on every tie. As the final operation of this unit, three men placed the new tie plates on the ties in position to receive the new rail.

Immediately behind the adzers came a push car equipped for disassembling and assembling the adzer heads and grinding the adze bits. Three men were engaged in this work, one to carry the adzer heads between the machines and the grinder car, a second man to remove the bits and assemble them after they had been ground, and a grinder.

This unit, therefore, consisted of 23 men. Thirty-two men were em-

Three Sets of Three Men Each Did the Gaging

Spiking Was a Hand Operation Throughout

The Welding of the Signal Bonds Completed the Operation

ployed in this unit in 1927, or 9 more than in 1935, the adzing alone requiring 20 men at that time, as compared with 6 last year. In 1927, no men were assigned to drive down the spike stubs, every adzer being expected to do this when he encountered such stubs, although one broom man was employed to sweep the tops of the ties. In making the comparison for this unit, it should be understood that the three men who were engaged in keeping the adze bits sharp were included as a part of the unit, while in 1927 the tool repairmen who ground the hand adzes were not. While it was not possible to make a detailed comparison of every item included in this preparatory work, 38 men were employed in this advance group in 1935, while 91 were required in 1927, a total reduction of 53 men.

With one exception, exactly the same organization, method and equipment were employed in both years in the unit that placed the rail. Using a Burro rail crane in both years, with 1 operator, 1 tongman handled the rail tongs and 2 men guided the rail into place. This year one of the latter also inserted the expansion shims, and another man, known as the thermometer man, kept track of the temperature of the rail and removed the shims after the joints were applied. In 1927, a thermometer man was not employed, but 2 men were engaged in handling the shims, one to insert and another to remove them. There was thus a reduction of one man in this unit.

Bolting

Two push cars were attached to and pulled by the rail crane. The first contained a barrel to hold a supply of drinking water, and carried a complement of extra tools. The second was a supply car from which three men distributed spikes, bolts, spring washers and anti-creepers for the following unit, of which these men were a part. Four men were engaged in applying the joints and starting the nuts, which were then tightened by two men using a Nordberg bolt tightener. This unit thus consisted of nine men.

By way of contrast, this unit consisted of 19 men in 1927, of whom 6 were engaged in distributing material and 8 in applying joints and starting the nuts. In this connection, it is well to remember that the toeless joint which was used with the 112-lb. rail is easier to apply than the angle-bar type, and this may account for some of the difference in the number of men engaged in applying joints. The bolt tightener employed in 1935 required two men for its operation and it brought the bolts to the desired tension. The equipment used in 1927 required one machine operator and two tool handlers, but it was unable to bring the bolts to final tension, for which reason it was necessary for two men with hand wrenches to give the nuts two or three turns before they were fully seated.

Gaging

After the rail had been bolted, 9 men, in three sets of 3 each, did the gaging and 22 men completed the spiking. It will be noted that the spiking was done manually, 31 men being engaged in this operation. In 1927, mechanical spike drivers were employed, 30 men being required to do the gaging and start the spikes.

Comparison of the Number of Men in Rail Gangs in 1927 and 1935

	1927	1935	Difference
Preparatory work	91	38	—53
Setting in rail	6	5	—1
Joints	19	9	—10
Spiking	45	33	—12
Signal gang	3	6	+3
Miscellaneous	2	5	+3
Work train	15	18	+3
Supervision	4	6	+2
Total	185	120	—65

These were followed by the spiking equipment with which there were one operator and two men. It was also necessary to assign four men to pull and redrive by hand such spikes as had been bent by the mechanical drivers. This unit, therefore, required 37 men, or 6 more than were necessary by reverting to hand spiking. In 1935, the anti-creepers were applied by 2 men, while 8 were assigned to this work in 1927, a further reduction of 6 men, or a total reduction of 12 men in this unit, as compared with 1927.

Next, a signal unit composed of two welders and two helpers welded the signal bonds at the joints, so that the bonding was completed as the rail was laid and the automatic signals were ready to function within a few minutes after closure each day. As a part of this unit, but usually working well in advance of the bonding, the signal foreman and an assistant foreman attended to the application of the insulated joints. In 1927, only three signal men were assigned to the rail gang, so that there was an increase of three men in this unit.

Five men were engaged in miscellaneous tasks which were not assigned to any particular unit. In this group 2 men carried water, 1 man picked up dropped tools and returned them to the extra supply on the push car attached to the rail crane; 1 man turned the old rail up workway to facilitate loading; and 1 man recorded heat numbers, the heat number of every rail being taken in consecutive order and referred to mile posts, after it was in place in the track. This compares with two water boys in 1927.

Bringing up the rear, except for a short period in the morning while it was distributing material for the day's work, the work train with 18 men, 3 more than in 1927, picked up the old rail and other material. New material which had not been used was seggregated and redistributed the following day. Except the rail, all of the old material was classified as it was picked up, the usable items and scrap being loaded separately.

Summarizing the foregoing detailed comparisons of the individual units for 1927 and 1935, in the former year 185 men were employed, including a general foreman and 3 assistant foremen, while this year the gang numbered only 120 men, or 65 less, including a general foreman, 2 foremen and 3 assistant foremen. A more direct comparison of the number of men in each group is shown in the accompanying table.

It is interesting to note that the largest reduction in the number of men occurred in the work of removing the old rail and preparing the ties to receive the new rail. Both the pulling of the spikes and the adzing of the ties was done by hand in 1927 because equipment for these tasks was either not available or not acceptable. In the short space of eight years, however, effective equipment had been developed for both tasks.

A comparison of the amount of work accomplished per man, including the foremen, in the two years under consideration is also of interest. In 1927, the rail gang averaged 9,683 ft. of track a day for 12 days, or 52.9 track feet for each man in the gang. In 1935, owing to the fact that much of the rail was laid through towns where numerous turnouts and street crossings retarded progress, the general average was lower. However, where these obstructions did not interfere, the progress amounted to 7,920 ft. a day, or 66 track feet a day per man employed, a gain of approximately 25 per cent, most of which can be attributed to the use of equipment of improved design.

The organization of the 1935 gang, a development of that of preceding years, was worked out by J. A. Peabody, then engineer maintenance, under whose general direction the work was done. The late P. J. McAndrews, roadmaster, was in direct charge in the field.

See Typical Snow Scenes on Following Two Pages

Railroads Battle Record Snow and Cold

NOT FOR many years, if ever before, have the maintenance forces of the railroads been called upon to cope with such widespread and long continued heavy snows and severely cold weather as prevailed throughout the north-central states almost continuously throughout February. With temperatures ranging down to 45 below zero and repeated heavy snows piling on top of one another, maintenance forces have been taxed to the limit of human endurance in opening, and keeping open, lanes of traffic through snow-filled cuts and in rescuing trains and even snowplows stalled in huge drifts. On lines in the affected area every available piece of snow-fighting equipment has been pressed into service and thousands of extra snow shovelers have been added to the regular forces in an effort to keep traffic moving on both main and branch lines.

The states which have been most severely affected by the intense cold and heavy snows are Illinois, Iowa, Nebraska, South Dakota, Wisconsin, Michigan and Minnesota, although portions of other states over a large area have also been affected. Sweeping from west to east, repeated snow storms laid successive blankets of snow on the ground, while high winds caused the formation of drifts around all obstructions. Between snow storms extremely low temperatures tended further to increase suffering, to slow up transportation agencies and to make outdoor labor difficult in the extreme.

As a result of these storms and abnormally cold weather, railway operation in this area has been affected more severely than at any time during the last 37 years. In spite of herculean efforts by railroad forces, main line schedules in the affected area were repeatedly disrupted for hours and occasionally for days at a time, while service on many branch lines was abandoned until main line traffic could be restored to something like normalcy. For instance, up to February 9, principal passenger trains came into Chicago from the West not more than 8 hr. late, nor more than 4 hr. late from the East, but when another blizzard struck on February 8-10, main line trains on western roads were as much as 24 hr. late and many were annulled. Additional snow on February 15-17 and reoccurring subzero temperatures caused further disruption to schedules and the difficulty of keeping cuts open increased as the snow became deeper.

Repeatedly, passenger trains became stalled in huge drifts and had to be rescued by snowplows, supplemented by crews of snow shovelers. On doubletrack main lines efforts were frequently concentrated on keeping only one track open, while in one case, traffic over an alternate freight line was practically at a standstill for three weeks, while snowplows and crews of snow shovelers fought desperately to clear away the huge accumulations of snow in the cuts.

Most severe weather conditions in 37 years disrupted railroad schedules in February, with the result that snow-fighting forces were taxed to the limit in keeping main and branch lines open.

However, while disruption of railroad traffic was serious, it was temporary and most trains returned to something like their regular schedules soon after each storm, highway traffic was paralyzed for weeks with the result that many communities were entirely dependent on the railroads for necessities of life, such as food and fuel. In fact, in a number of instances communities, otherwise entirely isolated, were saved by the arrival of railroad snow-fighting crews followed by trains bearing fuel and supplies.

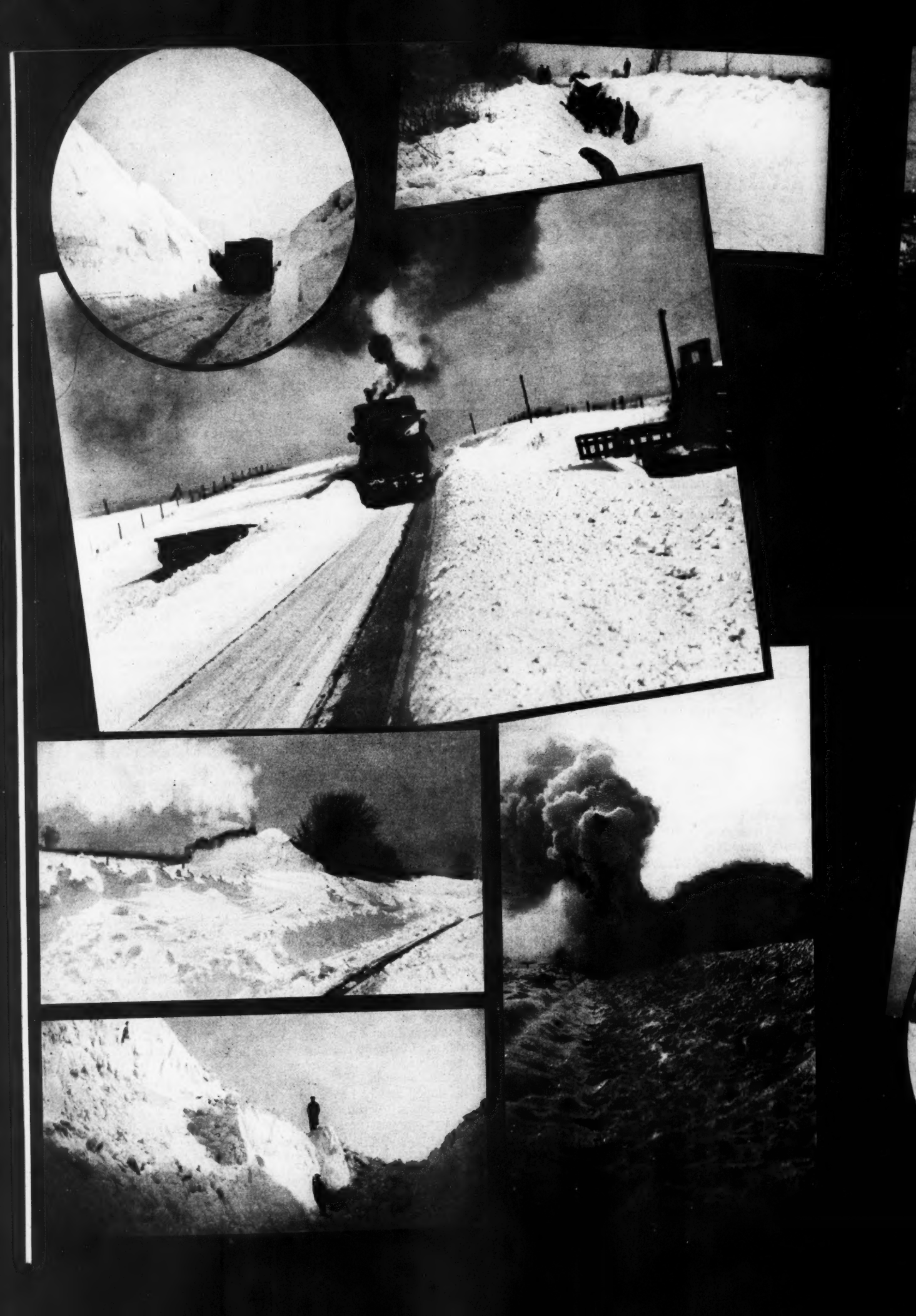
Snow fighting has been difficult and fraught with hardship. Owing to the great depth of some of the drifts, snowplows, even when double-headed, frequently became stalled and had to be dug out by relief crews. Because of the extremely low temperatures, employees were not only subjected to great hardship and suffering but their efficiency was considerably reduced. Another hampering factor, attributable to the low temperatures, was the fact that fine, or "sugar," snow was constantly whipped along the ground by the wind, even when no snow was falling, with the result that cuts tended to fill rapidly and plows had to be operated constantly. Moreover, because of the relatively great depth (20 ft. or more) of some of the snow cuts it has been necessary to shovel the snow out in relays, with men stationed at convenient elevations on the side slopes.

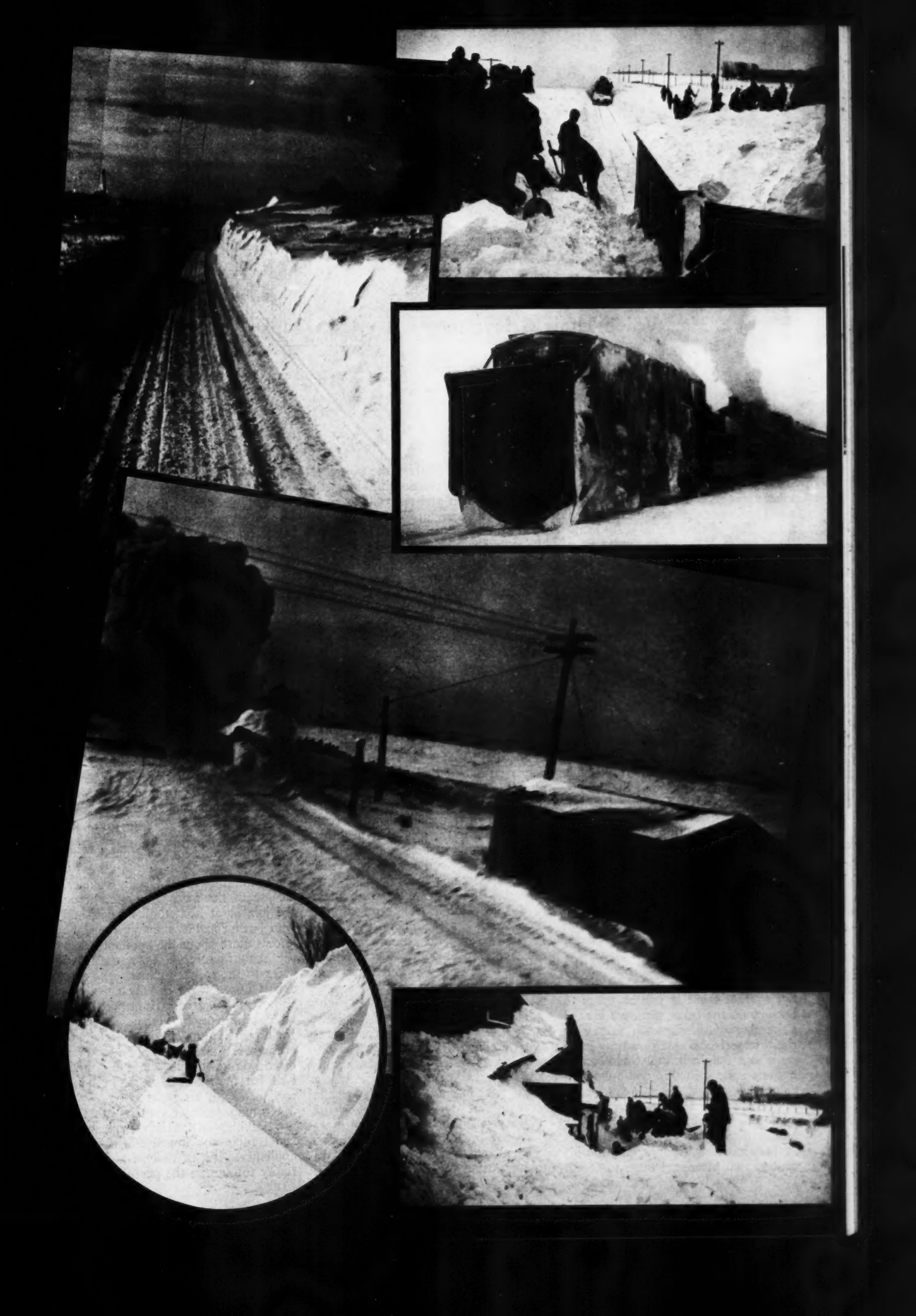
Roads Affected

Among the railroads affected most severely were the Illinois Central, the Chicago, Rock Island & Pacific, the Chicago, Burlington & Quincy, the Chicago, Milwaukee, St. Paul & Pacific, the Chicago & North Western and the Chicago Great Western. The most troublesome location on the Illinois Central was at Macy, Iowa, a point on its main line, where a train stalled in a 2½-mile cut on February 4 delayed service for 24 hr. Again on February 8, another train became stalled at the same location, despite the fact that a plow had opened up the line a short time previously. On February 9 alone at least five trains were stuck in drifts at various points in Iowa and Illinois, while a Russell snow plow, together with three locomotives, were being dug out of a 15-ft. drift near Haldane, Ill., by a crew of 30 men. At one time it was reported that for two miles west of Dubuque, Iowa, there was no place where the depth of snow along the track was less than 20 ft.

Under these conditions the Illinois Central found ample need for its snow fighting fleet of 18 wedge plows and 10 Russell plows, and also pressed into snow fighting service 7 spreaders and 3 ditchers. To provide sufficient power for bucking the huge drifts the plows were frequently double-headed and, in addition, were accompanied by gangs of shovelers containing as many as 50 to 60 men. Another measure involved the provision of crews of shovelers on passenger trains so that immediate aid would be available if such trains should become stalled.

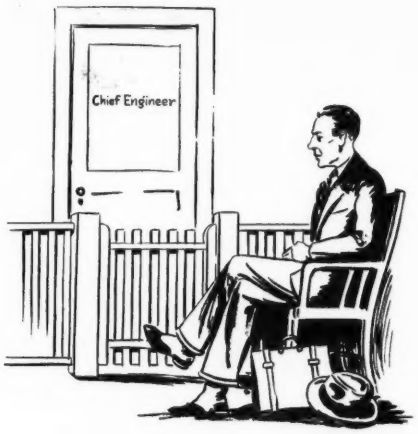
(Continued on page 168)





Why Some Salesmen Die Young

In Which Five Railway Supply Men Voice Their Grievances



THE buyer and the seller cannot always be able to see eye to eye. One must apply sales force, while the other exerts sales resistance, until there is a "meeting of the minds." And since there are included in the category of buyers and sellers, individuals representative of the whole gamut of human personalities, it follows that the circumstances attending the contact of the salesman with his prospect are not always pleasant. However, the amenities of business would be of no consequence if it were not for the fact that the manner in which the buyer and seller treat each other has a bearing on the efficiency with which business is done. Railway supply men, for example, sometimes impose themselves needlessly on railway men, while the latter have been responsible for an enormous waste of the time of the former. In the first case the railways suffer directly, while in the second case the resulting increase in the cost of selling leads to higher prices for what the railways buy.

One side of this problem, namely, the shortcomings of the salesmen as seen by the railway officer, was presented in a series of anonymous contributions that appeared in *Railway Engineering and Maintenance* for March, 1935 under the title "Why Some Salesmen Can't Get In." Believing that there is just as much to be said on the other side, we invited a number of supply men to review their experiences with railway men on whom they call, and their contributions appear in this and following columns.

The object of this series of articles is not to afford an opportunity for supply men to get certain grievances "off their chests," nor is this the incentive that prompted them to accept our invitation. Rather, the object is to improve the relationship between the supply men and the railway men for the purpose of facilitating the merchandising of the products that the railroads buy.

Letting George Do It

THE most serious obstacle that confronts the salesman of a new product is to overcome the mental inertia of the men on whom he calls. This reluctance to take up new ideas is not nearly as prevalent as it used to be; in fact, it may well be said that the depression has done more to jar railway men out of their fixed habits of mind than all the efforts of the supply men. By that I do not mean that railway men as a class have not been enterprising in the past. The progress that was made in the second half of the "twenties" in the introduction of mechanical appliances in track work is proof enough of their willingness to try new ideas. At the same time, there were all too many who preferred to wait and see what success the X.Z. & Y. railroad had with a device before they risked their own reputations to the extent of recommending its purchase.

The job of the salesman has been made easier in another way as the result of changes wrought by the depression. System maintenance officers have been compelled to acquire a much more intimate knowledge of the more minute details of the work of their men than they had in pre-depression days. Perhaps they had too much money to spend in the flush days to have time for details, but I find them much easier to deal with these days because they know more about what my product is doing. They are also much more ready to listen to the suggestions and recommendations of their subordinate officers.

These comments apply not only to the problems attending the sale of power equipment to the railroads, but also to controversies arising out of the definite need for changes in practice or organization to obtain the most effective results from the use of a machine designed to supplant manual methods. The higher officers have been much more insistent on strict adherence to methods set forth in the "Book of Rules" than the men on the firing line who are in a position to see the practical problem presented. Of course, there is always danger in generalization—there are plenty of system maintenance officers who have always been on the job and who have been as alert in sizing up the situation as the man who is on the ground every day.

But the supply man has his troubles, also, with the man who is right on the job, or at least thinks he is, and who is thoroughly convinced that he knows more about the appliance than the manufacturer does himself. I refer to the railway expert who sees a half dozen ways in which the machine can be greatly improved, and who withholds his recommendation for a purchase unless certain changes are agreed to. Perhaps he may even offer a design of his own and request bids for machines to be built in accordance with his plan.

No manufacturer contends that he is infallible or that there may not be room for some improvement in his appliance. But in view of his opportunity to observe the performance of

his machine on not one but many railways and under a wide variety of physical conditions, and in view of his knowledge of the requirements imposed in manufacture, he should be in a better position than anyone else to judge what improvements may reasonably be made. But granting that the changes proposed by the railway man are thoroughly sound, it is not practicable to incorporate them until such time as it becomes feasible to get out a new model. Even with work equipment of the types bought by the railways, the economies to be derived from quantity production of duplicate units have an important bearing on the price that a manufacturer must ask for his product.

Some manufacturers have complained of expenses incurred as a result of unreasonable demands made by some railroads in servicing equipment purchased. They cite instances where a service man has been compelled to travel hundreds of miles only to find that a fuse was burned out or that a few nuts needed tightening. We, also, have had such experiences, but we welcome the opportunity to keep in touch with the performance of our machines, for it is only by seeing them at work that we can offer suggestions designed to improve performance or to expand the field for their usefulness.

Other Duties

The closing of the contract does not terminate the salesman's job. It is just as important to follow up the sale with whatever measures are necessary to see that the machine is used properly. In some cases it even becomes a matter of getting it used at all. Almost every supply man has been chagrined by the sight of one or more of his outfits stored along the right-of-way, with every appearance of having been idle for months, and it is not always easy to break down the inertia or lack of interest that is responsible for such a failure to use his equipment. In some cases, he may encounter outright antagonism, but more often than not, he himself is responsible for this attitude. Most likely he has centered his sales efforts on the system officers, without taking the necessary steps to see that the men down the line were sold also.

In these circumstances it may happen that instead of trying to use a machine, the men in the field are spending their time trying to find reasons why it cannot be used. To my mind this is an exceedingly short-sighted attitude, whether it concerns my appliance or those of my competitors. The machine has been bought and paid for, so if it is not used the railroad rather than the supply company is the principal loser.

Another source of trouble to the supply man arises from the purchase of spare or replacement parts. Many of these are stock materials that can be bought on the open market, with the result that the purchasing agent will often suggest substitutions to which the officer of the using department will frequently offer no objections. This practice may result in some savings, but it should be undertaken with extreme caution because it may lead to trouble that will prove more expensive than the saving in the price of the parts. If parts are bought from other than the manufacturer of the appliance, they must be of the same quality of material and finished to the same close tolerances as those that the maker has found it necessary to incorporate in his device.

Sell Transportation

THE experience of the writer in soliciting business from railway officers has been by no means unsatisfactory; in fact, it has been almost invariably the opposite. The unfortunate experiences have usually occurred at some remote point where an officer, for one reason or another, has been seemingly unwilling to realize that his caller came a long distance to make the visit and should be accorded some courtesy, to say the least. If engaged at the time of the call, he should make some effort to grant at least a few minutes to a caller from a distance.

Salesmen Are Prospective Purchasers of Transportation

It has long been my belief that many railroad officers in engineering positions could well emulate the attitude of the purchasing officers of our more progressive railroad systems. In other words, they could give proper consideration to the value to the railroad of the advertising and good will to be gained by having the salesman leave with a kindly feeling toward the railroad. I feel that this phase of the matter is often overlooked; it is forgotten that the salesman represents a concern that is also a prospective purchaser of the only commodity a railroad has for sale — transportation. Since a railroad can only be known through its officers and employees, they have an opportunity, when salesmen call, to do a good selling job for their own company.

It is true that salesmen may occasionally abuse the courtesies extended to them, but in most cases, cognizant of the fact that the railway officer is a busy man, they will stay no longer than is necessary to discuss briefly the subject at hand, unless the officer indicates otherwise, and the good-will value to the railroad of such courteous consideration to the salesman will be far reaching.

Naturally the salesman most useful to his firm is one who not only has a thorough knowledge of his own products but is also familiar with railroad problems generally, and is thus able to discuss such matters intelligently with railroad officers in presenting his own proposition. For this reason, a call by a salesman of this class may well be worth the time consumed.

Some Tough Customers

A RAILWAY supply man who nurses a grouch doesn't last long, because a cheerful disposition is among the first requisites for success as a salesman. But no such rule applies to the railway officer, for his demonstrated capabilities as an engineer and an executive will normally outweigh any shortcomings of personality manifested by his manners (or lack of them) in receiving callers in his office. However, to the seasoned supply man, rebuffs, discourtesies and broken engagements are all in the day's work, and he makes it his business to find a way to "get under the hide" of the tough customer, or to develop other channels through which to advance the interests of his product.

He realizes, also, that irritability on the part of a railway officer is not

infrequently the result of overwork, and that interruptions in the course of a busy day to receive callers do not help matters. In these circumstances the wise salesman terminates the interview as quickly as possible and requests an opportunity to return at a more favorable time. No such extenuating circumstances can be offered for the man who keeps a caller waiting for an hour while his actions and posture, as seen through the glass partition, belie the statement that "he is busy just now." Such tactics serve no purpose for anyone. The caller is at least entitled to a frank statement that his request for an interview will not be granted.

But the salesman's real job starts when he gains an audience, and the most trying obstacle that he must expect to face is inattention. Here, again, he is aware that his host is a busy man—that he has dozens of serious problems demanding his attention and that he must leave town again before he can possibly get all his work done. On the other hand, the salesman's experience has taught him that the real executive is the man who eliminates everything from his mind except the matter immediately at hand—for whatever time he can devote to it. To do otherwise is to waste the time of both parties to the interview. The supply man cannot object if his time is cut short or if interruptions occur, but he has a right to undivided attention if he is to have attention at all.

Insincerity

Another trial of the salesman is insincerity on the part of his prospect. There is, for example, the man who distorts the facts, either deliberately or to cover up an inadequate knowledge of them, in an effort to place the visitor's product in an unfavorable light. Such tactics may originate solely from a desire to bolster up a position taken previously or to support a preconceived theory that has no foundation of fact. In some cases it is purely a matter of obstinacy—the caller is invited in for no other reason than to provide the excuse for an argument. Then too, there is the man who will agree with every statement that the salesman makes, but who will be found subsequently to have taken an opposing stand when the product is discussed at the staff conference.

In still another class is the man who takes the salesman's time for the purpose of acquiring a detailed knowledge of the product with no other object than to learn just how far he can go with a design of his own without infringing on patents. In other cases, he may pursue the same tactics with the salesmen of competing products and then ask for competitive bids on a design that incorporates what he believes to be the best features of each.

It is understood, of course, that the illustrations cited above are the exception. Most railway men are willing to meet supply men half way and work out their mutual problems on a basis that is fair to both. Railway men as a class, have a high standard of business ethics.

Must Cultivate Prospects

It is the salesman's job to cultivate his prospects and the wise salesman has a reasonable amount of good taste when it comes to such matters as entertainment. Most railway men take a common sense attitude towards it also. The luncheon date, especially, has come to be recognized as a time-saver, and it is no more than reasonable that the expense should be borne by the individual at whose instance the engagement was made. There are, however, a few railway men who are not averse to inviting entertainment, who suggest that the salesman call at 11:30, or who will call at the salesman's office just before lunch time. But in most cases, the benefit to be gained is well worth the expense. Occasionally the supply man is confronted with an obvious demand for entertainment of an expensive and entirely unwarranted character, but in the majority of such cases it is his own fault. The salesman who has developed a reputation as a lavish entertainer has a hard time living it down.

On the Whole Railway Supply Men and Their Clients Get Along Well Together

On the whole, railway supply men and their clients get along well together. They realize that each group has something to give to the other, and that cooperation will result to their mutual advantage. However, for the attainment of a thorough understanding, both parties must realize that each has a responsibility to his employer that outweighs any other considerations.

Short-Sighted Policies

IT has been my experience in selling mechanical equipment to maintenance officers that they are, as a rule, aware that their success is influenced largely by their alertness in keeping advised of the economic value of modern equipment and appliances, and improved methods of doing their work. Without this information they will be unable to make proper recommendations or specify the materials and equipment best adapted to their needs. For that reason, they are usually courteous, open-minded and receptive. Those who have mechanical equipment under their jurisdiction are sincere in their efforts to co-operate with the manufacturers in making its use successful and profitable to the railroad.

Manufacturers of mechanical equipment for track work are always willing to listen to constructive suggestions from railroad officers, based on field experience with their equipment, that will result in improvement in design and thus make for easier handling and more economical and successful operation of the equipment. However, they dislike to be forced into special construction to meet the fancied idea of some railroad officer that his conditions are entirely different from those prevailing on any other railroad. A special design to meet such a demand calls for only limited production, and this means higher cost of manufacture that sometimes results in prohibitive prices.

It frequently develops that if the railroad officer in question would accept the equipment that has been designed after very thorough and careful study of the conditions on the railroads as a whole, and put it into service on his railroad, he would find that it will meet his conditions equally as well and sometimes better than the specially designed equipment which he insists upon. Owing to the fact that it is built to meet the popular demand of the railroads, which justifies quantity production, he can purchase it at considerably less cost and at the same time get much quicker delivery. Also, in the event of breakdowns or emergencies, he can obtain the necessary parts from stock. Therefore, use of the standard machine results in real benefit and genuine economy to his railroad.

We realize that conditions are not alike on all railroads and sometimes not alike on all divisions of the same railroad, but we do feel that a mechanical unit used economically and

to advantage on one railroad, can be used to equal advantage and economy on others, with perhaps slight modifications or refinements in some special cases, thus enabling the manufacturer to maintain a standard design which permits of quantity production.

The manufacturers of railroad equipment in this country have helped greatly in advancing the science of railroad construction, maintenance and operation. Their engineering staffs and officers have spent years in developing the most effective devices to conserve labor and insure safety. This has cost many thousands of dollars. The manufacturers are proud of their accomplishments and gladly stand behind their products. In the hope of advancing the industry they give freely of this knowledge, often without regard to monetary reward. But frequently they must ask themselves, "Has this been properly appreciated."

For instance, the engineering department of a large railroad calls upon a manufacturer for advice. The manufacturer places his entire stock of information in the hands of the railroad. Time and study are necessary to ascertain facts upon which to base specific recommendations. Most railroad officers fully appreciate this, but when bids for the new equipment are requested, this special service is not taken into consideration and the contract goes to another company that has just entered the field and is lacking in this practical experience.

Quite possibly the first price might be slightly lower, but will the final results be the same? Is it not possible that the first manufacturer, seasoned by years of actual experience will be able to deliver a more satisfactory product on which the ultimate cost will be lower, the economies effected greater, and service rendered superior?

Some Hard Cases

IT IS equally unfair to judge all supply representatives, or all maintenance officers by the exception. My comments have nothing whatever to do with the hundreds of considerate and intelligent maintenance officers, who, in spite of the pressure of their many responsibilities, at least attempt to be courteous to the many railway supply men who call on them. Instead, my remarks are concerned solely with those maintenance officers, who, for reasons unknown to me, evince ignorance of many of the qualities of gentlemen when they are in their inner sanctums, behind a broad desk. I believe that we supply salesmen have every right to be accorded a courteous reception by maintenance officers, if for no other reason than that as traveling representatives we are patrons of the railroad, which in my opinion places these officers in the same general field of endeavor—that of salesmen.

It is most discouraging, upon arriving at an office after a long trip, to be met by an officious clerk whose one aim in life apparently is to make the "getting in" as difficult as possible. It is indeed irksome to be kept waiting indefinitely, only to be told eventually—"you will have to call again," or that so and so is—"too busy to see you today," or as happened in one instance—to find that the individual I was calling on had quietly slipped out his private exit to be gone until the following day.

A Waste of Time

Sometimes, when I ask to see a particular officer, my card is returned with the suggestion that I talk to a subordinate; naturally I offer no objection, but this substitution often results in a waste of time and effort, for

Interruptions Will Occur

frequently the man to whom I am referred is entirely unfamiliar with the problem to be discussed, or else is in no position to make any decision, and his time, also, is taken up unnecessarily.

On other occasions, when I have been successful in reaching my prospect; a gruff, half-hearted hello is the only greeting—never a suggestion that I be seated or make myself comfortable, regardless of the temperature. I make a brave attempt at stating the purpose of my call, but do not make much headway, largely because my host's attention is centered upon mountainous piles of correspondence through which he searches endlessly. Invariably such a call results in a net loss to both parties.

But sometimes I am more fortunate and, having secured my prospect's attention, we get down to business, only to be brought up with a short turn upon learning that I have picked a chap who has an inborn grudge against my company or some individual in it, with the result that I listen minutes on end to a tirade that is most embarrassing to me, to say the least, and of no benefit to the man himself.

An Embarrassing Situation

One officer, upon whom I had called and who apparently showed some interest in our product, was interrupted by a phone call. Without any apology on his part, he became engaged in a long and wrathy conversation that

In Spite of the Pressure of Many Responsibilities

ended with a severe "calling down" for the unfortunate party on the other end of the line. For the remainder of my visit I listened to a harangue on the short-comings and stupidity of his subordinates in general.

Sometimes officers are unjustly prejudiced against certain products. One such individual summoned me, and on being shown into his presence, I was regaled with a general condemnation of a device which, he claimed, caused him considerable trouble. I listened patiently and, when my chance came, I tactfully informed him that our company had not furnished the article in question. It developed later that this same man was one of those rare individuals who knows "all about everything," that he rarely accepted or followed the manufacturer's advice or instructions concerning the devices he purchased, and consequently did not secure the performance to which he was rightfully entitled.

Really Human

The sales representative spending countless nights on sleepers, contrary to much that has been said about his not patronizing the railroads, is after all really human, and is indeed thankful that experiences such as I have related, are rare. I have only the sincerest appreciation for all of the maintenance officers who are ever courteous and glad to see me, even though they are not always in a position to favor me with their business.

How Far Behind?

(Continued from page 147)

lay of $19,379,000 for ballast and of $10,444,000 for water supply maintenance during the same period. The outlay for maintenance of tools and machines during following years was necessarily reduced, but it is interesting to note that whereas the total expenditure for maintenance of way and structures was cut an average of 59 per cent during 1932-33-34, the expenditures for the upkeep of roadway machines were cut only 51 per cent in 1932, 49 per cent in 1933 and 28 per cent in 1934, while the curtailment for tools averaged about 57 per cent. As a matter of fact, the railroads spent almost as much for the maintenance of tools and equipment in 1932-33-34 as they did for ballast and water service combined.

Expenditures for Roadway Machines, Small Tools and Supplies

	Roadway Machines		Tools and Supplies	
	A & B	Operation	A & B	Operation
1925	$1,895,000	$6,223,000	$260,000	$10,769,000
1926	2,059,000	6,957,000	218,000	11,876,000
1927	3,415,000	7,115,000	159,000	11,564,000
1928	2,347,000	7,063,000	219,000	10,759,000
1929	4,079,000	7,767,000	236,000	12,102,000
1930	3,241,000	7,074,000	144,000	9,470,000
1931	1,715,000	5,258,000	428,000	4,343,000
1932	300,000	3,471,000	64,000	4,447,000
1933	318,000	3,586,000	41,000	4,464,000
1934	381,000	5,044,000	42,000	5,663,000

This comparison stands out in sharp contrast with the situation in respect to the net capital expenditures for tools and equipment, namely, the outlay for additions and betterments, less credits for retirements. In the five years, 1925-1929, the net capital charges for tools averaged $218,693 and for roadway machines $2,759,603. In contrast, the net charges for new machines during 1932-33-34 averaged only 12.1 per cent of the corresponding figures for the predepression period. The corresponding figures for tools were 29.7 per cent in 1932 and 19.2 per cent in 1934, while in 1933 the credits for tools retired exceeded the charges for additions by $64,980.

Inference Is Obvious

The inference to be drawn from these figures is obvious. The railroads spent relatively large amounts to keep tools and equipment in repair or for replacement, and only insignificant sums for new and improved appliances. They could readily pursue this policy, because the drastic curtailment of maintenance of way work placed a surplus of equipment at their disposal and they could dispense with the use of all but the newer and more efficient machines. At the same time, this practice involves a disregard of the marked improvements that have been made in tools and machinery during the period of restricted purchases, or of the proportionately high cost of keeping the old equipment in condition for use. It should be obvious, therefore, that expanded programs to make good the large volume of deferred maintenance will necessarily release a large volume of long deferred purchases of work equipment of all classes.

This study of the extent of deferred expenditures for maintenance of way and structures has been predicated on the trends of operations prior to 1930, when decisions as to the requirements for a high standard of upkeep were not influenced by the specter of rapidly declining revenues, but making due allowance for the decreased rate of deterioration that follows a reduction in traffic. While the standard of upkeep during the "twenties" was a high one, it was no higher than is necessary today. In so far as it concerns the tracks on a considerable number of lines, the old standard was not high enough, for these tracks are now carrying trains at speeds far exceeding the maximum speeds of 1929.

Battle Record Snow and Cold

(Continued from page 161)

On the Milwaukee, the most troublesome location was at Sturtevant, Wis., between Chicago and Milwaukee, where, because of the great rapidity with which the snow drifted, it was necessary to keep two rotaries and a spreader in constant service, supplemented by a gang of 75 men. However, severe conditions were also encountered on this line throughout Iowa, South Dakota and Southern Minnesota, and the road was forced to bring into action all its snow-fighting equipment, consisting of 70 wedge plows, 4 rotaries (including 2 transferred from its western lines), 45 flangers and 6 spreaders. With snow piled to depths of as much as 28 ft. in some cuts, this road stationed watchers at the most troublesome locations, who were provided with portable telephones attached to the dispatcher's line. So widespread were conditions requiring the use of rotary plows that these machines were kept in service 24 hr. daily.

On the North Western

Probably no road experienced greater difficulty in keeping its lines open than the North Western. This company's freight line between Chicago and Milwaukee gave particular trouble and was closed almost continuously for three weeks, traffic being routed over the company's passenger line between these points during this period. A rotary plow was in service constantly on this line and was supplemented at times by one or two Russell plows and as many as 300 snow shovelers. Illustrative of the severity of the conditions on the freight line is the fact that the snow was piled to depths of 15 ft. or more along cuts only 2 ft. deep. With snow difficulties of almost equal intensity occurring on many other parts of the system, this company estimates that its snow-fighting activities during the first three weeks of February cost upwards of $300,000. Its snow-fighting equipment included 4 rotary plows, 3 single-track and two double-track Russell plows, 93 wedge plows and 5 ditchers equipped for fighting snow.

On the Rock Island and on the Burlington, where 20-ft. snow drifts up to 1½ miles in length were encountered, snow-fighting equipment and personnel were also taxed to capacity. With 1 rotary, 17 wedges and 3 flangers available, the Rock Island was forced to operate its snow-fighting equipment constantly, in order to keep its lines clear of snow, while the Burlington used 2 rotaries, several Juuls, 16 spreaders and many wedge plows.

The Hazard Increases with the Number of Men Employed

Does Work Equipment Promote Safety?

By A. H. PETERSON
Roadmaster, Chicago, Milwaukee, St. Paul & Pacific

While eliminating drudgery in many maintenance tasks, machinery is also lessening the hazards to employees and reducing the accident ratio. Careful operators are the key to success in accident prevention.

IT is an axiom of modern railroading that safety is of first importance. Railway men are interested not only in the savings in labor made possible by the mechanization of hand operations, but also in the effect that such machinery will have on their safety records. In these days of restricted revenues, power machines of many types have been placed in operation on every railroad. It is interesting, therefore, to scan the pros and cons of their performance as they relate to safety.

The term work equipment covers a wide field. For the purpose of this discussion, it will include any power machine which serves to replace labor on tasks formerly done by hand. Motor cars are not included.

It is obvious that manufacturers of track machinery have had to demonstrate the economies of their machines to railroad managements. They have also been forced to prove beyond question not only that a given machine will reduce cost, but also that the quality of the work is equal or superior to that done by hand. That these contentions have been proven is shown by the growing use of machinery of all kinds in track work.

Lowered costs result largely from the savings effected through the reduced number of men required with machine operation. A piece of work equipment, such as a rail layer, requires a single operator and three men who assist in hooking, heeling and guiding each rail into position in the track. With the 112-lb. and 131-lb. rail being laid on many main lines, a rail-laying machine and its crew of 4 men does the work of 16 to 20 men with hand rail tongs. With 75 per cent less men engaged in the operation, the probabilities of accidents are reduced in the same proportion. Reducing the number of men necessary for any track operation commonly reduces the number of accident possibilities. Furthermore, it becomes correspondingly easier for foremen to supervise more closely the fewer men actually employed.

All machinery must, of course, be properly cared for. It should be well lubricated, overhauled regularly and maintained in proper condition at all times. On rail-laying cranes, the rail hooks must be replaced when any signs of wear are noted. Cables and cable clamps must be inspected daily. Booms should not be operated at too great a radius when handling heavy

rail of the longer lengths. It is customary to carry a few short rails on the side of the machine to act as a counterbalance in keeping the wheels of the rail crane on the track.

Rails should be so distributed that the need for running the machine forward and backward will be reduced to the minimum. Above all, the rail machine operator must be reliable. A single false move on his part may crush a man's foot or cause his death. A rail weighing in the neighborhood of a ton cannot be dropped suddenly from any great height without inviting disaster. The fullest co-operation and understanding must obtain at all times between the operator of any machine and the men who function as helpers.

Power Tampers Are Used on Most Railroads

Heavy machines, such as rail layers, often work so far from a passing track or spur that they must be set off along the track when trains are due. It is necessary that these setoffs be built with care after a selection of suitable locations has been made well in advance. If they are built along fills, ties or other timber must be used in their construction. The cribbing at the rear of such setoffs must be built carefully or it may give way as the machine is shoved upon it. Clayey fills are especially dangerous and should not be used as sites for rail-laying machine setoffs. Failure to observe this precaution may result in a machine tipping completely over and endangering the life of not only the operator but of other workmen. It should be needless to add that setoffs should be so built as to permit proper clearance from passing trains.

Locomotive cranes do every class of heavy work. They may be used to load and unload rail, ballast, snow, dirt, switch material and for countless other tasks. Not only do they reduce the number of men required in such jobs as loading old ties in yards and unloading heavy frogs and railroad crossings, but they lessen the hazards to the reduced number of men actually employed.

In one large Chicago terminal a crane has been used to unload, pile and reload in excess of 10,000 switch ties annually. The same crane has loaded large numbers of cars of dirt and as many as 100 cars of old ties released from track in connection with tie renewals in one season. It has unloaded 160,000 ft. of rail in one season without a single accident. Handling switch ties, fresh from the treating plants, is a dangerous job if done by hand. A crane does this work more economically and far more safely than is possible by hand labor.

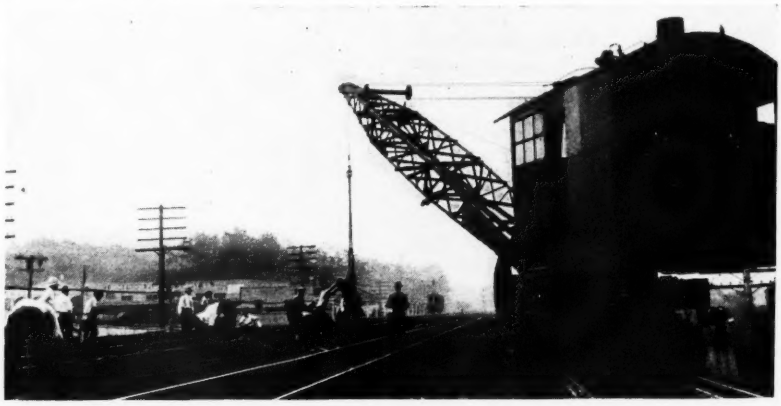
Experienced Operators Vital

A crane operator must be experienced, reliable and able to diagnose the ailments of his machine. He must be careful of fouling wires or overhead obstructions with his boom. Cables and clamps must be checked carefully. Gas tanks must never be filled when the ignition is turned on. No adjustments should be made while the motor is running. Rail must always be center-marked to prevent the danger of one end being jerked up while the other remains on the ground. The clutch is of vital importance in such a machine. If not in good condition, it may permit a heavy load to drop suddenly and cause serious injuries to members of the gang.

In loading operations where considerable work is done in one location, a tendency to shirk sometimes develops in train crews assigned to cranes. No move should be made without a signal from a member of the train crew. Whistles are the best means of conveying crane signals because of the noise of the motor. Trainmen should also be on the alert for trains passing on adjacent tracks and should halt the work in sufficient time to permit the operator to straighten and lower his boom onto his boom car. Cranes working on main lines should be protected by train orders and proper flagging at all times.

Adzing machines require that all operators wear leg and foot guards as well as goggles. Stubs of spikes must be driven down carefully in advance of the adzing and the ballast cleaned away from the top of all ties and from between the ties to a depth slightly greater than that of the required adzing. The chisel cutting points revolve at high speed and often throw stones or other material with great force—hence the need for care in cleaning away all scrap and ballast prior to adzing. Other laborers in the gang must be instructed to pass adzing machines at a safe distance and to turn their faces away while in the vicinity of such equipment.

Hand adzing has been a prolific cause of foot injuries. Such accidents have been eliminated by power adzing. Likewise, the number of men required for adzing operations has been greatly reduced, thus lessening the potential number of accident possibilities. Dressing track by hand does not appear to be a dangerous operation; yet many men have received injuries in this work. Ballast shapers and bulldozers do this work not only far better and far more cheaply but with practically no injuries. Once more the operator is the most potent factor. Upon his care depends the safety of the operation.



The Crane Operator Must Be Experienced and Reliable

Bolt tighteners completely eliminate the hazard of men becoming injured on account of wrenches slipping off bolts. Hernia cases in connection with hand bolt tightening are common. Proper flag protection for bolt-tightening machines and the need for seeing that such machines are set off to clear trains properly are the only necessary precautions that need be taken.

Spike pullers eliminate most of the claw bar work on large rail operations. The mashing of fingers on account of spike heads breaking off or a claw bar slipping suddenly and crushing fingers between the rail and the bar are completely eliminated. The fatigue of claw bar work in hot weather is well known. Men who are overheated and tired out are more susceptible to injury. Most of this drudgery is eliminated by the use of machine spike pulling.

Power Jacks and Tampers

Power jacks and power tampers are in use on most roads. Hand-operated jacks are prone to throw track out of line and when high raises are being made, a sudden kink may develop that is sufficient to injure workmen. Hand jacks sometimes slip cogs due to wear or foreign objects in the working parts, causing track to drop suddenly, with the possibility of an accident. Power jacks should be used with care on narrow head rail as there is danger of the clamps slipping off the rail while the raise is being made. It is safer to haul power jacks to a job on push cars than to tow them on their own wheels. If towed, the movement should be slow and the rail-engaging pawls securely fastened up to prevent them from dropping down and engaging the rail while the machine is in motion. When towed, they should invariably be hauled at the rear of all trailers or push cars.

Power tampers are rather heavy. It is usually necessary to alternate two men on each tamper. One source of danger in connection with power tamping lies in the tamper operator accidentally dropping the tool on his own feet. Men have been known to strike and injure their feet with shovels while hand tamping, but accidents of this kind are rare.

Mowing machines eliminate the danger of hand mowing with scythes. Footing is often precarious along fills. cases are common where men have fallen onto their own scythes in such locations. Operators of mowing machines must have the protection of proper train orders. They must watch carefully for obstructions, dogs, children or trespassers.

Air rail loaders take most of the danger out of the unloading of rail. Air lines, valves, cables and clamps must be checked frequently. Care should be used by the operator in seeing that all men in a car of rail are in the clear before lifting or depositing a rail. Where rail is being picked up while a train is in motion, a rhythm must be maintained by the air man in the operation of his machine to insure that the rail hook is returned to the men on the ground in time to insure their being able to handle the subsequent rail properly. Care should be used in the speed of the work train. Too rapid a movement is dangerous. Necessary signals for hoisting or lowering must be given to the air operator by a designated man. Promiscuous signals must not be given.

Adzer Operators Must Be Protected

Space does not afford a complete discussion of the many other varieties of work equipment. They are of varied design and serve a multiplicity of purposes. Suffice it to say that all track machines require certain safeguards. Among those are properly trained, intelligent operators, efficient maintenance, adequate protection by flagmen, or train orders or a combination of both the latter.

Noise a Hazard

Perhaps the most important hazard connected with track machines is that of noise. A machine, when gasoline-powered, creates so much din that it is difficult to hear the approach of trains or other equipment. Men become so engrossed in their work that they fail to keep a careful lookout. Laxity in this respect cannot be tolerated. Other machines are so unwieldy that the mere act of setting them on or off the track creates a danger. Improvement here can be expected.

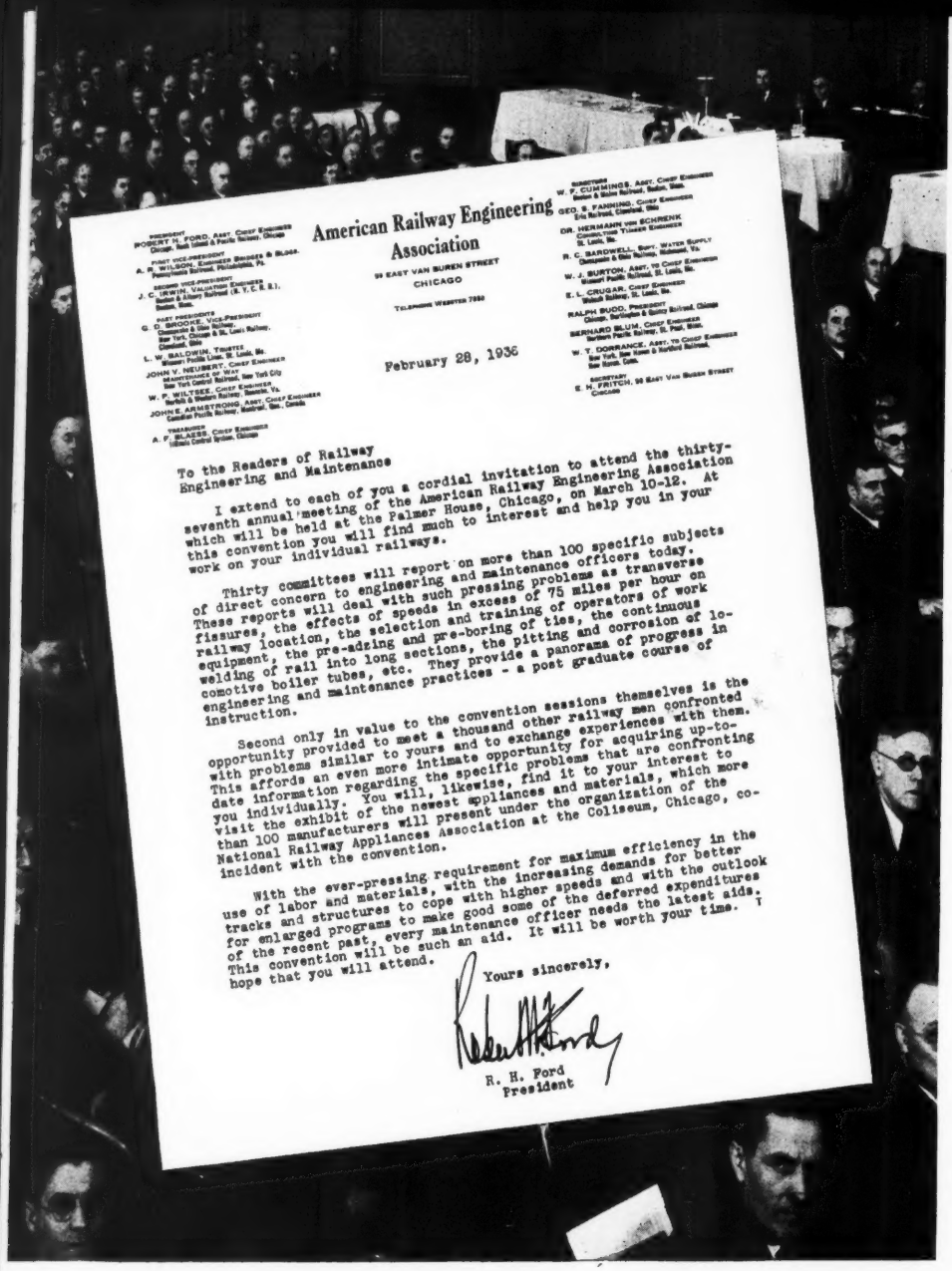
It is doubtful if track department safety records would be what they are today without the present extensive use of work equipment. Most accidents in connection with such machines are chargeable to man failures. Man must master the machine of his creation or it may prove a Frankenstein to its maker. No one can deny the fact that machine work on track has helped our railroads to weather the depression. Nor will we deny the allegation that the need for fewer men to accomplish a given task has materially lowered the number of accidents sustained.

While the possibility of a robot trackman is extremely fanciful, yet one by one the arduous, dangerous hand labors of the past given way to machines. Manufacturers of such machines design their work equipment for safety. They are ever open to suggestions for improvement. The field for track machinery is still large. Railway men everywhere welcome any track machine which moves towards the conservation of man power, the reduction in the cost of operation and, most important of all, a safer accomplishment.

Trespassers

L. G. Bentley, chairman of the Committee on Education, Safety Section, Association of American Railroads, has issued a circular that deals particularly with trespassing and conveys numerous striking lessons from the records of the past 10 years. In the years 1925-1934, nearly 30,000 persons were killed while trespassing on railway property, and no less than 6,000 of the 30,000 were killed while trespassing on trains. More than three times that number were killed while trespassing on tracks. The trespassers are classed under five heads: Persons under 14 years, persons 14 to 21, railway employees off duty, tramps, and other persons; and this last class is made up mainly of ordinary citizens.

A. R. E. A.



American Railway Engineering Association

59 EAST VAN BUREN STREET
CHICAGO

February 28, 1936

To the Readers of Railway
Engineering and Maintenance

I extend to each of you a cordial invitation to attend the thirty-seventh annual meeting of the American Railway Engineering Association which will be held at the Palmer House, Chicago, on March 10-12. At this convention you will find much to interest and help you in your work on your individual railways.

Thirty committees will report on more than 100 specific subjects of direct concern to engineering and maintenance officers today. These reports will deal with such pressing problems as transverse fissures, the effects of speeds in excess of 75 miles per hour on railway location, the selection and training of operators of work equipment, the pre-adzing and pre-boring of ties, the continuous welding of rail into long sections, the pitting and corrosion of locomotive boiler tubes, etc. They provide a panorama of progress in engineering and maintenance practices - a post graduate course of instruction.

Second only in value to the convention sessions themselves is the opportunity provided to meet a thousand other railway men confronted with problems similar to yours and to exchange experiences with them. This affords an even more intimate opportunity for acquiring up-to-date information regarding the specific problems that are confronting you individually. You will, likewise, find it to your interest to visit the exhibit of the newest appliances and materials, which more than 100 manufacturers will present under the organization of the National Railway Appliances Association at the Coliseum, Chicago, coincident with the convention.

With the ever-pressing requirement for maximum efficiency in the use of labor and materials, with the increasing demands for better tracks and structures to cope with higher speeds and with the outlook for enlarged programs to make good some of the deferred expenditures of the recent past, every maintenance officer needs the latest aids. This convention will be such an aid. It will be worth your time. I hope that you will attend.

Yours sincerely,

R. H. Ford
President

President Ford extends an invitation to the convention to readers of Railway Engineering and Maintenance

THE American Railway Engineering Association will hold its thirty-seventh annual convention at the Palmer House, Chicago, on March 10-12. At this meeting there will come up for consideration a wide variety of subjects dealing with current problems in the maintenance of tracks and structures. These topics will be presented largely in the form of reports of committees, supplemented by individual addresses in a few instances.

The American Railway Engineering Association is unique among organizations in the railway field and, in fact, among technical associations at large, in the volume of its work. It functions primarily through 30 standing and special committees composed of more than 900 members of the association. Each of these committees is working on from one to 10 specific problems.

The A.R.E.A. is distinctive among technical associations also in the continuity of its work. Organized in 1899, it has met annually thereafter without a single break. During the period of federal control, when many organizations suspended activities, it was encouraged to continue its work as essential to the operation of the railways. Likewise during the period from 1931 to 1934, when many organizations again ceased work as a measure of economy, the A.R.E.A. continued to function with the full co-operation of railway managements, although curtailing its activities into two crowded days. Last year the association returned to its normal three-day program.

The convention this year will be presided over by Robert H. Ford, (assistant chief engineer, C. R. I. & P.), president of the association, assisted by Vice-Presidents A. R. Wilson (engineer bridges and buildings, Penna.), and J. C. Irwin (valuation engineer, B. & A.), and Secretary E. H. Fritch.

The program for the convention, indicating the order of the committee reports, is presented on the opposite page. Attention is called especially to the fact that all sessions will be on Chicago Daylight Saving Time—one hour faster than Central Standard Time.

To Hold Annual Convention in Chicago

Wide variety of subjects covered in the 30 committee reports to be presented at this meeting

Program for the 37th Annual Convention

Palmer House, Chicago
(All sessions on Chicago Daylight Saving Time, One Hour Faster than Central Standard Time)

Tuesday, March 10

Morning Session—9 A.M.

Convention called to order
President's address—Robert H. Ford
Report of Secretary E. H. Fritch
Report of Treasurer A. F. Blaess
Reports of committees on
- Standardization
- Roadway
- Stresses in Railroad Track
- Yards and Terminals

Afternoon Session—2 P.M.

Reports of committees on
- Water Service
- Signals and Interlocking
- Electricity
- Economics of Railway Operation
- Economics of Railway Labor

Adjournment at 4 p.m. to visit the exhibit of the National Railway Appliances Association at the Coliseum.

Wednesday, March 11

Morning Session—9 A.M.

Reports of committees on
- Ballast
- Ties
- Rail
- Track
- Complete Roadway and Track Structure
- Wood Preservation

Afternoon Session—2:30 P.M.

Reports of committees on
- Iron and Steel Structures
- Live Load and Impact
- Economics of Bridges and trestles
- Wood Bridges and Trestles
- Masonry
- Waterproofing of Railway Structures

6 P.M.

Western Railway Club, Hotel Sherman—Dutch Treat Dinner

8 P.M.

Address on "The Importance of Track Structure in Railroad Transportation," by Robert Faries, assistant chief engineer-maintenance, Penna.

Thursday, March 12

Morning Session—9 A.M.

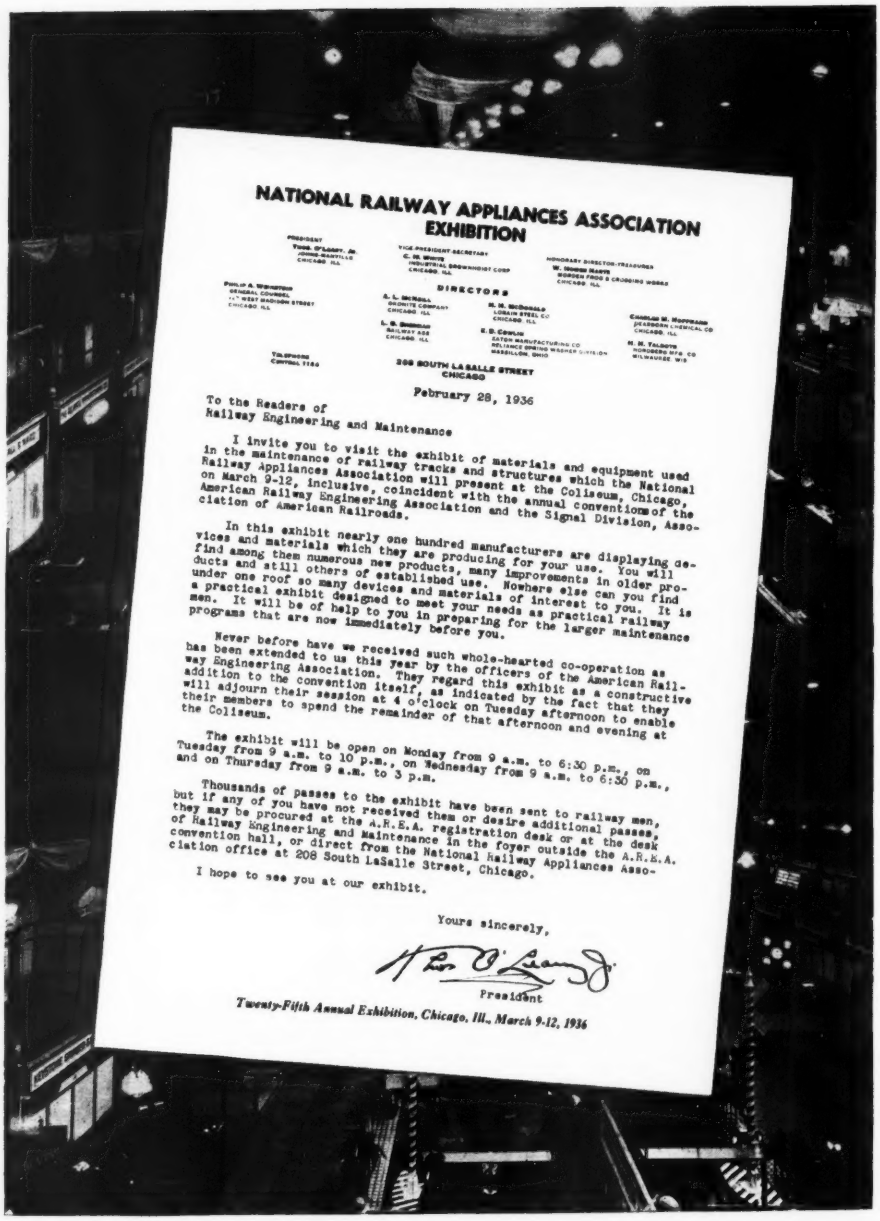
Reports of committees on
- Highways
- Waterways and Harbors
- Records and Accounts
- Uniform General Contract Forms
- Maintenance of Way Work Equipment
- Economics of Railway Location

Afternoon Session—2 P.M.

Reports of committees on
- Clearances
- Buildings
- Shops and Locomotive Terminals
- Rules and Organization

Closing Business

Materials



NATIONAL RAILWAY APPLIANCES ASSOCIATION
EXHIBITION

DIRECTORS

208 SOUTH LA SALLE STREET
CHICAGO

February 28, 1936

To the Readers of
Railway Engineering and Maintenance

I invite you to visit the exhibit of materials and equipment used in the maintenance of railway tracks and structures which the National Railway Appliances Association will present at the Coliseum, Chicago, on March 9-12, inclusive, coincident with the annual conventions of the American Railway Engineering Association and the Signal Division, Association of American Railroads.

In this exhibit nearly one hundred manufacturers are displaying devices and materials which they are producing for your use. You will find among them numerous new products, many improvements in older products and still others of established use. Nowhere else can you find under one roof so many devices and materials of interest to you. It is a practical exhibit designed to meet your needs as practical railway men. It will be of help to you in preparing for the larger maintenance programs that are now immediately before you.

Never before have we received such whole-hearted co-operation as has been extended to us this year by the officers of the American Railway Engineering Association. They regard this exhibit as a constructive addition to the convention itself, as indicated by the fact that they will adjourn their session at 4 o'clock on Tuesday afternoon to enable their members to spend the remainder of that afternoon and evening at the Coliseum.

The exhibit will be open on Monday from 9 a.m. to 6:30 p.m., on Tuesday from 9 a.m. to 10 p.m., on Wednesday from 9 a.m. to 6:30 p.m., and on Thursday from 9 a.m. to 3 p.m.

Thousands of passes to the exhibit have been sent to railway men, but if any of you have not received them or desire additional passes, they may be procured at the A.R.E.A. registration desk or at the desk of Railway Engineering and Maintenance in the foyer outside the A.R.E.A. convention hall, or direct from the National Railway Appliances Association office at 208 South LaSalle Street, Chicago.

I hope to see you at our exhibit.

Yours sincerely,

President

Twenty-Fifth Annual Exhibition, Chicago, Ill., March 9-12, 1936

The exhibit of maintenance of way materials and equipment has become an important feature of engineering week. The president of the N.R.A.A. extends an invitation to readers of Railway Engineering and Maintenance to visit it.

AT 9:30 o'clock on Monday morning, March 9, the doors of the Coliseum, Chicago, will open for the twenty-fifth exhibit of engineering, maintenance of way and signaling materials and equipment, presented by the National Railway Appliances Association. This exhibition, which has been presented annually, beginning with 1909 (except during 1932-1933-1934), co-incident with the conventions of the American Railway Engineering Association and the Signal Section, Association of American Railroads, is the outstanding display of materials and devices employed in the construction and maintenance of tracks and structures. Nowhere else can interested railway officers find similar opportunity to gain information regarding the newest products of railway supply manufacturers.

The educational value of this exhibit is evidenced by the recognition accorded it by the A.R.E.A., which has incorporated in its program this year provision to adjourn on Tuesday afternoon at 4 o'clock to encourage its members to spend the remainder of the afternoon and evening at the Coliseum, the exhibit remaining open until 10 o'clock that evening.

As this issue goes to press, over 80 manufacturers have contracted for space for the display of their products. In this exhibit will be found many new devices and materials and an even larger number of improvements in earlier products. The exhibit will also include those materials whose merit has already been established, but for which there will be increasing demand this year. This exhibit is being directed by Thomas O'Leary (Johns-Manville Sales Corporation), president, and Charles H. White (Industrial Brownhoist Corporation), secretary and director of exhibits, of the National Railway Appliances Association.

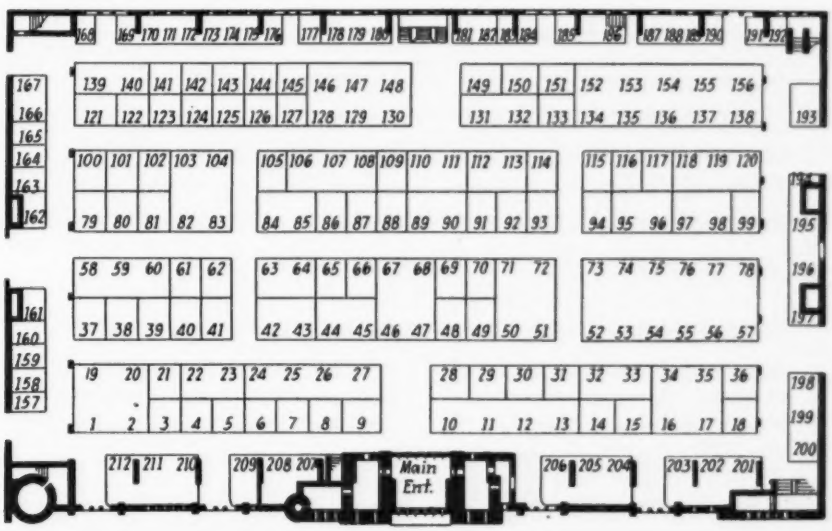
The companies which will participate in this exhibit are listed on the opposite page. To aid in locating their exhibits, a floor plan of the Coliseum is also shown, on which the different spaces are numbered to correspond with the list.

on Exhibit at Chicago

Manufacturers will display products employed in construction and maintenance work

Exhibiting Members

Adams & Westlake Co., Chicago....82-83-103-104
Air Reduction Sales Co., New York....181-182
American Car & Foundry Co., Chicago....100
American Fork & Hoe Co., Cleveland, Ohio.... 6
American Hoist & Derrick Co., St. Paul, Minn....133
Armco Culvert Manufacturers Association, Middletown, Ohio....106-107-108
Austin Western Road Machinery Co., Aurora, Ill....115
Automatic Crossing Gates, Inc., Louisville, Ky....101
Barco Manufacturing Co., Chicago....105
Barrett Co., New York.... 91
Buda Co., Harvey, Ill....46-47-67-68
Chicago Pneumatic Tool Co., New York....10-11-12-13
Chipman Chemical Co., Bound Brook, N. J.... 39
Cleveland Frog & Crossing Co., Cleveland, Ohio....97-98
Conley Frog & Switch Co., Memphis, Tenn....160
Crerar, Adams & Co., Chicago.... 30
Cullen Friestedt Co., Chicago.... 86
Dearborn Chemical Co., Chicago....50-51-71-72
De Sanno & Son, A. P., Philadelphia, Pa....145
Dickinson, Inc., Paul, Chicago.... 37
Duff-Norton Manufacturing Co., Pittsburgh, Pa....22-23
Eaton Manufacturing Co., (Reliance Div.), Massillon, Ohio.... 31
Elastic Rail Spike Co., Indianapolis, Ind.... 40
Electric Tamper & Equipment Co., Ludington, Mich....125
Evans Products Co., Detroit, Mich....139-140-166-167
Fairbanks, Morse & Co., Chicago....52-53-54-55-56-57-73-74-75-76-77-78
Fairmont Railway Motors, Inc., Fairmont, Minn....134-135-136-137-138-152-153-154-155-156
Fansteel Metallurgical Corp., North Chicago, Ill....164
General Electric Co., Schenectady, N. Y....149
Gould Storage Battery Co., Depew, N. Y.... 5
Hayes Track Appliance Co., Richmond, Ind....114
Hollup Corp., Chicago.... 18
Hubbard & Co., Pittsburgh, Pa.... 88
Industrial Brownhoist Corp., Bay City, Mich.... 94
Ingersoll-Rand Co., New York....1-2-19-20
Johns-Manville Sales Corp., New York....194-195-196-197
Jordan Co., O. F., East Chicago, Ind.... 38
Joyce-Cridland Co., Dayton, Ohio....112-113
Kalamazoo Railway Supply Co., Kalamazoo, Mich....24-25-26-27
Kerite Insulated Wire & Cable Co., Chicago....89-90
Lehon Co., Chicago.... 99
Locomotive Finished Material Co., Atchison, Kan.... 48
Lundie Engineering Corp., New York....165
MacRae's Blue Book Co., Chicago....159
Magnetic Signal Co., Los Angeles, Cal.... 79
Machinery & Welder Corp., Minneapolis, Minn.... 9
Maintenance Equipment Co., Chicago....131-132
Mall Tool Co., Chicago....126
Mallory & Co., P.M., Indianapolis, Ind.... 29
Metal & Thermit Corp., New York....58-59-60
Morden Frog & Crossing Works, Chicago....42-43
Morrison Railway Supply Corp., Buffalo, N. Y.... 87
National Carbide Sales Corp., New York....183
National Carbon Co., New York.... 65
National Lead Co., New York.... 4
National Lock Washer Co., Newark, N. J.... 66
Nichols & Bros., Geo. P., Chicago....193
Nordberg Manufacturing Co., Milwaukee, Wis....146-147-148-128-129-130
Okonite Co., Passaic, N. J.... 62
Oxweld Railroad Service Co., Chicago....63-64
Pettibone Mulliken Co., Chicago....95-96
Pocket List of Railroad Officials, New York.... 28
Pomona Pump Co., Pomona, Cal....162
Portland Cement Association, Chicago.... 41
Power Ballaster Co., Chicago....178-179-180
Pyle-National Co., Chicago....44-45
Q & C Co., New York.... 92
Racor Pacific Frog & Switch Co., Los Angeles, Cal.... 80
Rail Joint Co., New York....84-85
Railroad Accessories Corp., New York....109
Railway Engineering and Maintenance, Chicago.... 93
Railway Purchases & Stores, Chicago....161
Railway Track-Work Co., Philadelphia, Pa....118-119-120
Ramapo Ajax Corp., New York.... 81
Rawls Co., S. E., Streator, Ill....16-17-34-35
Sellers Manufacturing Co., Chicago....127
Syntron Co., Pittsburgh, Pa.... 7
Taylor-Wharton Iron & Steel Co., Easton, Pa....32-33
Teleweld, Inc., Chicago.... 69
Templeton, Kenly & Co., Ltd., Chicago.... 36
U. S. Wind Engine & Pump Co., Batavia, Ill....121
Western Railroad Supply Co., Chicago....110-111
Woolery Machine Co., Minneapolis, Minn....158



Floor Plan of the Exhibit of the National Railway Appliances Association at the Coliseum.

Rail-End Pre-Heater and Heat Treater

THE Morrison Railway Supply Corporation, Buffalo, N.Y., has introduced a portable pre-heater, known as the "Buddy" heater, for pre-heating rail ends preparatory to welding or heat-treating operations. With this heater, which weighs 50 lb., it is said that rail ends may be heated to a temperature of 400 deg. F. in 3 min. Its use for pre-heating rail ends, it is said, reduces the consumption of acetylene and oxygen in gas welding and assures good fusion in electric welding. The pre-heater is also adapted for melting snow and ice at switches.

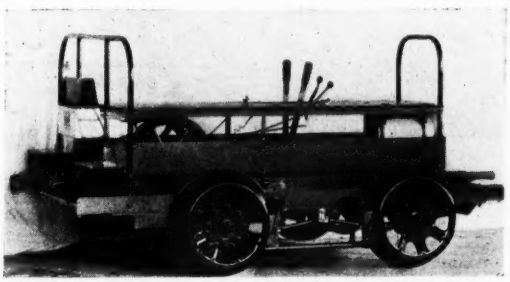
The Buddy Pre-Heater.

Essentially the heater consists of a Hauck oil burner mounted on a hood of sheet metal which fits over the head of the rail, the flame being directed into the hood through a small hole in the end. The hood, which is lined with renewable fire brick, is 17 in. long, is open at the bottom and the ends are recessed to a depth of ¾ in. to assure a snug fit over the heads of the rails. The fuel used is carbon oil which is supplied to the burner under a pressure of 30 lb. per sq. in. from a 1½-gal. tank mounted over the hood. The tank is equipped with a plunger-type pump and a pressure gage and is also fitted with a handle to permit ready handling of the unit when moving it from joint to joint. The heater consumes about three quarts of fuel per hour.

It is estimated that the fire-brick lining and the burner in this unit will have a service life of about 1,000 hr. in actual service, following which the firebrick and the burner can be renewed and the heater returned to service. It is claimed that the use of this heater does not result in the formation of a deposit of carbon on the rail.

Fairmont Light Section Motor Car

FAIRMONT Railway Motors, Inc., Fairmont, Minn., has added a steel-frame light section car, known as Model M14 Series E, to its line of railway motor cars. The new car is designed to parallel the performance of the M14 Series D car which has an aluminum alloy frame and which was described in the February issue of *Railway Engineering and Maintenance,* page 98. To this end the same engine, transmission, wheels, axles, bearings and nearly all the brake parts used in the Series D car are found also in the new model. The difference between the two cars lies in the fact that the Series E car has a frame of steel angles, a seat top and sides of tempered Masonite, and various other parts of iron or steel. While the new car is somewhat heavier than the Series D, it may be readily handled by one man, the lifting weight on the extension handles at the rear end being 105 lb. It is pointed out that the car weight of 720 lb. means little as both ends of the car need never be lifted at the same time.



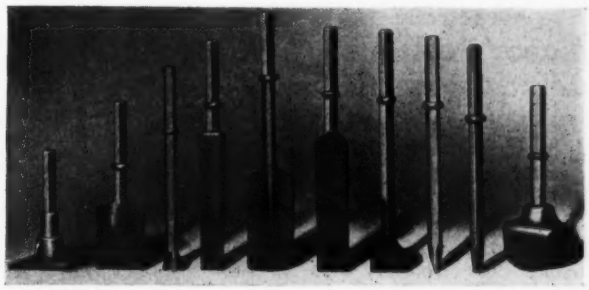
The Fairmont Model M14 Series E Car

Smaller Barco Gasoline Hammer

THE Barco Manufacturing Company, Chicago, has brought out a new gasoline hammer, known as Model J-1, which is similar in design and construction but smaller and lighter than this company's Model H-5 gasoline hammer which was described in the January, 1935, issue of *Railway Engineering and Maintenance,* page 41. Briefly, these hammers, which have two hand grips for one-man operation, are each powered with an air-cooled, two-cycle, single-cylinder gasoline engine in which the free floating steel piston delivers from 1,200 to 1,500 blows per minute to the striking tool. Ignition current is supplied by a dry battery and a coil which are contained in a separate box with the connecting wire to the engine passing through one of the hand grips.

The new model, which is about 20 lb. lighter than the larger size, is adapted particularly to continuous back-fill and rock-fill tamping. It is also pointed out that the new hammer may be employed successfully for other operations, although, where the work is very heavy and the conditions are extreme, use of the heavier model is recommended. Tools having a 1-in.

hexagonal shank are used with Model J-1, the tools that are available including a back-fill tamper, asphalt chisel, drill, frost wedge, spade, digging tool, chisel, moil point, gad and sheeting driver.



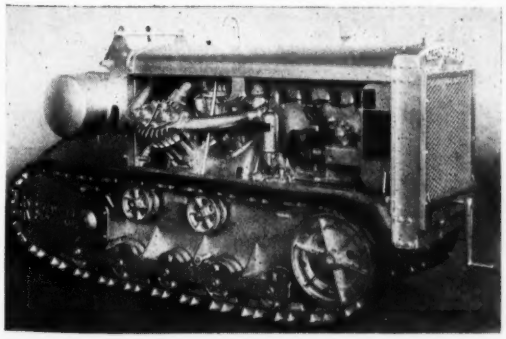
Tools Used with the Barco Gasoline Hammers

Crawl-Air Compressor

THE Ingersoll-Rand Company, New York, has brought out a second model Crawl-Air type air compressor, similar in many respects to the earlier model, but of larger capacity and including a number of refinements and improvements. The new design, known as Model 160, has a capacity of 160 cu. ft. of air per minute, sufficient to operate 12 MT-3 low-air-consumption tie tampers, and is equally well adapted for operating a wide variety of pneumatic tools such as are employed in rail laying and in bridge and building work.

The new model is 9ft. 10 in. long, approximately 14 in. longer than the earlier model of 105 cu. ft. capacity, but it is the same width as the earlier model, 3 ft. 6 in., in order that it may be operated between the rails or along the shoulder of the track. The air compressor of the new model is of the two-stage, air-cooled design of the company, which can be furnished with either a Waukesha gasoline engine drive or an I-R Type H oil engine drive.

The crawler mounting of the new model, which is propelled by a powerful air motor, embodies a number of improved features which are said to increase the tractive effort of the machine, minimize friction, and to make the unit as a whole more flexible than the earlier model. It is claimed that the machine will climb grades up to 40 per cent and that, because of its low center of gravity, it will not tip over on an incline of 45 deg. Like the earlier model, it can be loaded under its own power on trailer or flat cars for transportation from job to job. The gross weight is 8,000 lb.

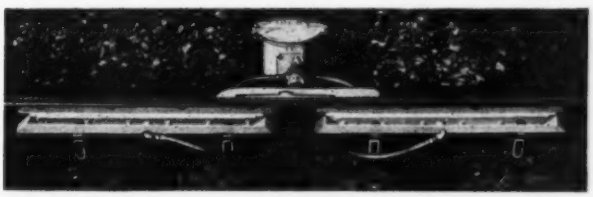


The New Model 160 Crawl-Air Compressor

Improves Meco Rail Lubricator

DURING the past year a number of improvements have been incorporated in the type MB Meco rail and flange lubricator, manufactured by the Maintenance Equipment Company, Chicago. One of these involves the elimination of the set screws and set screw lugs formerly used to obtain vertical adjustment of the lubricant distributing assemblies and their replacement with spacers between the tops of the interchangeable rail clamps and the bottoms of the lubricant assemblies which they support. In addition the lubricant distributing assemblies are now supported at two points instead of at four points as previously, this revision being made possible by the strengthening of the assemblies. With this improvement it is said that wave motion in the rail, if present, imposes no undue strain on the parts.

A special adaptation of this lubricator, which provides lubrication for switch points and curved leads through turnouts, crossovers and slip switches, is now available for use in freight and passenger terminals. This adaptation may also be used to provide protection against flange wear on high rails in territories containing many short reverse curves. Moreover, a special attachment is now available, which, when applied to the lubricator, permits all parts extending more than 5 in. from the rail to operate entirely below the tops of the crossties. With this attachment it is pointed out that the lubricator is adapted particularly for yard service where flat switching is done.



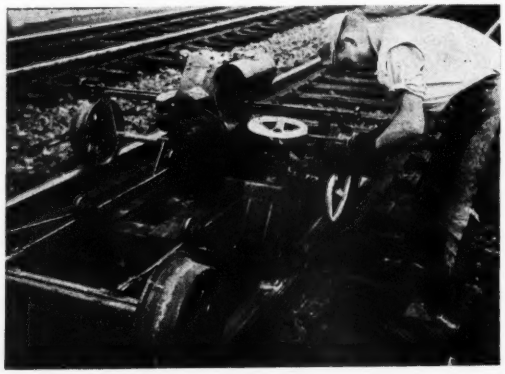
The Improved Meco Rail and Flange Lubricator

Cup Wheel Grinder

THE Railway Track-Work Company, Philadelphia, Pa., has brought out a cup-wheel rail grinder, known as Model GM-1, which embodies a number of unusual features of design. In this machine, which is carried on a four-wheel truck, the 10-in. grinding wheel is reciprocated over the work on a set of independent guides in planer-grinder fashion, the track wheels of the main carriage being locked or held in one position to prevent the irregularities of the rail surface being reflected in the ground surface of the rail. The guides, from which the grinder mechanism is suspended by means of double-flanged rollers, are said to be readily adjusted to produce various degrees of run-off or other desired variations in the finished surface. The total length of reciprocation is 18-in. which, with the 10-in. wheel, results in a total effective grinding length of about 28 in.

The cup wheel is mounted, tilted and driven around a common center line or axis. Aside from the reciprocating arm this grinder has only two operating controls, a vertical feed ad-

justment and a tilting control, the latter being of the worm and segment type. The design of the grinder is such that the two feeds may be adjusted independently of each other. In actual use the tilting control is said to act as both feed and tilt and about 90 per cent or more of the grinding can be done by means of this control alone. This is accomplished through the use of a shaped cam or track mounted on the main frame and a roller attached to the shaft of the vertical feed control. As the grinding head is tilted the roller on the feed control follows the lower edge of the cam and raises or lowers the grinding wheel the amount needed to give an accurately finished rail-head contour. While the cam is shaped for a particular rail section and may be readily changed, it is pointed out that one cam will serve for finishing the surfaces of a wide variety of rail sections.



The Model GM-1 Cup Wheel Grinder Provides for Automatic Contour Control

With this type of feed it is said that grinding may be continued by using only the vertical feed, manually controlled, until the grinding has reached a desired depth after which the operation is carried on with only the adjustment of the tilting control. The final finish may be secured by varying the adjustment of one or both controls as desired. Heavy springs carry the dead weight of the grinding wheel and its guard and at the same time serve to take up and remove any wear or vertical motion that may develop as a result of the continued use of the machine. Other features claimed for this machine are that it is fast in operation; that the operator can stand in a comfortable position while having a good view of the work; that no metal can be removed needlessly except by a deliberate effort on the part of the operator; and that it is impossible to gouge or cup the rail at the ends of the weld or to create shatter marks.

This machine is powered with a four-cylinder, 15-hp., air-cooled gasoline engine and weighs about 1,000 lb. However, it is also furnished with other power sizes and with an electric motor drive. A jack arrangement permits the grinder to be turned quickly from one rail to the other or to be removed from the track readily.

Racor Rail Lubricator

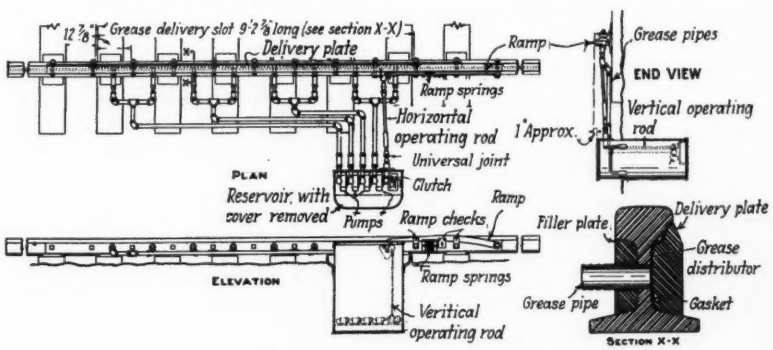
A NEW type of rail lubricator is being introduced by the Ramapo Ajax Corporation, New York. In this device, which is known as the Racor rail lubricator, four gear pumps actuated by a ramp deliver the lubricant from the reservoir through eight grease pipes to a chamber between a delivery plate and the running rail where it is forced out through a slot between the top of the delivery plate and the underside of the head of the rail. The grease delivery slot, which is 9 ft. 2⅞ in. long, is divided into eight delivery spaces, each 12⅞ in. long, by shims at bolts which maintain the slot to the proper width. Distributors on the delivery plate deflect the lubricant so that it is forced out of the delivery slot in a continuous line. Thus the grease is said to be picked up by the side of the wheel flange in such a manner that the flange retains the maximum amount of lubricant on the surface that comes in contact with the high rail on curves, with the result that a minimum amount is wasted.

In operation, the ramp of the lubricator is depressed by contact with the tread of each wheel passing over it, being returned to its original position by springs. This movement of the ramp transmits a back-and-forth rotation movement to a horizontal operating rod through a crank-and-link connection, which in turn transmits an up-and-down movement to a vertical operating rod through a crank connection. The vertical rod, through a clutch operates, four gear pumps in the grease reservoir, each of which consists of two closely fitting gears that are housed on the under side. The teeth of the gears are kept filled with grease from the upper side by gravity and as they rotate the grease is squeezed out from between the teeth and into the grease delivery pipes. The latter deliver the lubricant under pressure through the running rail into the opening back of the delivery plate and thence out through the delivery slot.

Extensive tests over a period of years are said to have demonstrated that this type of lubricator will protect curves for distances of from 10 to 15 miles from the point of installation without wasting the lubricant on tangent track. The operating parts are constructed with flexible connections and the lubricator is said to require only periodical inspections to determine that the grease reservoir is filled and that the operating parts exposed to the weather are kept oiled.

Improvements to Chipman Spray Car

THE Chipman Chemical Company, Bound Brook, N.J., is introducing the use of two sets of atomizing nozzles on chemical spray cars to permit the alternate application of both poisonous and non-poisonous weed destroying chemicals from the same car. With the new arrangement each type of chemical has its separate supply lines and propelling force from the solution car to the nozzle. With this



Drawing of the Racor Rail Lubricator

improvement it is no longer necessary, when poisonous chemical is being used, to stop the application of chemical through station grounds because of the poison hazard. By a manipulation of valves the application is switched from poisonous to non-poisonous chemical on entering the station grounds and back again on leaving them, without stopping the car. It is now possible, therefore, to apply weed killer with the Chipman equipment over an entire line in one trip, thus effecting a saving in work-train mileage. Because of the chemical reaction which takes place, it is not possible to apply both types of chemical simultaneously.

View of a Chipman Chemical Spray Car and Outfit

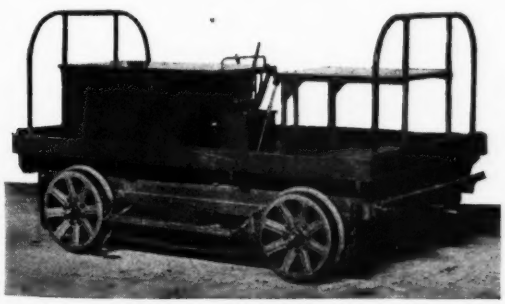
Fairmont Gang Car With Ford V-8 Engine

FAIRMONT Railway Motors, Inc., Fairmont, Minn., is now building a new extra-gang motor car, designated as Model A6 Series B, which is powered with an 80-hp. Ford V-8 engine. A feature of this car is the fact that the underframe of the all-steel chassis, which carries the engine and car body, rests on large coil springs. Thus protected from rail shock and wheel-on-rail vibration, the car is expected to have a long service life and it is anticipated that the number of engine overhauls will be substantially reduced. Moreover, as the spring-supported chassis increases the comfort of riders on long trips, it is said that the chassis of the new car may be equipped with a small coach body for use in official inspection service, or it may be converted to use in short line passenger and freight service with trailers. For these purposes, various types of closed bodies may be furnished or the bare chassis may be supplied to railroads preferring to construct bodies in their own shops.

The engine of the new car is rubber-mounted at all three points of suspension, this being made possible by the use of a propeller shaft drive. The Spicer shaft has a splined slip coupling and needle-bearing universal joints. All three forward speeds of the Ford transmission can be reversed to drive the car backward by a Fairmont directional gear surrounding the rear axle. The reversing mechanism includes a pinion, two bevel gears and a splined clutch. Other mechanical features of the car include 1 15/16-in. double-roll Timken axle bearings; 20-in. demountable wheels with 5/16-in. tires; 4-wheel, self-centering, adjustable brakes with iron brake shoes; and a Fairmont differential axle in front.

With the standard seats, this car will accommodate 10 or 11 men, while with hump-car type side steps outside the wheels 12 to 14 additional men can be carried, giving a total capacity of 22 to 25 men. A safety feature designed to decrease the hazard of injury when climbing on and off the car includes the provision of step boards, 5½ in. by 34 in., between the wheels, which are 10⅜ in. above the rail and 13⅝ in. below the deck. The motor car controls are placed in a cockpit, which feature is said to add to the safety of the car by protecting the driver and all controls from interference from material on the deck or men on the seats. The U-shaped tool tray contains nearly 32 sq. ft. of clear deck space.

This car weighs 2,368 lb. and is capable of a drawbar pull of 900 lb. However, the lift required to handle the car at setoffs and crossings is 609 lb. at the rear on extension handles which may be pulled out at either end of the car.



The Fairmont A6 Series B Extra Gang Car

Jordan Improves Spreader-Ditcher

PRIMARILY with the object of increasing the flexibility of its standard spreader-ditcher, the O. F. Jordan Company, East Chicago, Ind., has made a number of improvements in this machine, which can be applied to any all-steel Jordan spreader. Important among these improvements is a new method of opening and closing the heavy-duty box type wings, which embodies the use of three telescopic column braces for holding each wing in the operating position. Each telescopic brace has a gear-rack locking device, thus permitting the wings to be set readily at any angle from 25 deg. to 45 deg. with the track. These telescopic braces replace the knuckle type braces of the previous model, which had only one fixed operating position.

It is pointed out that the addition of the adjustable spread feature broadens the usefulness of the spreader in ditching narrow cuts and in-

The Improved Jordan Spreader-Ditcher

creases its effectiveness when used as a snowplow.

Another improvement to this machine includes the provision of new adjustable cutting blades on the front plow, which may be adjusted readily from level to 5 in. below the top of the rail. The car frame of the improved unit is also 7 ft. 6 in. longer than that of the previous model and is of heavier construction.

Spottamper

A LIGHT-WEIGHT, three-cylinder, air-cooled air compressor has been developed by the Ingersoll-Rand Company, New York, designed primarily to meet the need for a lightweight unit which can be handled readily by a small force engaged in spot surfacing work or in picking up low joints in the track. The unit is powered by a Waukesha four-cylinder, four-cycle gasoline engine and will operate two MT-1 or MT-2 tie tampers, or four of the newer MT-3 low-air-consumption tie tampers.

The spottamper as a whole is mounted in a substantial steel pan, which acts as a bed plate, and is 56 in. long, 33 in. wide, and 40 in. high. It weighs 975 lb. A feature of the unit is the provision of two long cylindrical air receivers, one on each side, with openings through their centers at each end. It is intended that these openings shall be used as sockets for lining bars used as extension handles, to facilitate the swinging of the unit to or from the track, or when maneuvering it about on the track shoulder. Grooved transverse rollers at the ends of the bed plate pan, projecting beneath the bottom of the pan, afford a means for rolling the unit on one of the track rails, or for shifting its position longitudinally along the track shoulder on a plank.

In addition to its use in connection with spot tamping, the new lightweight unit is equally well adapted for use by small gangs operating bridge cleaning and erection tools, wood working tools, paint sprays, rail oilers, and, in fact, any other types of air-operated tools or equipment within its capacity.

The New Spottamper Is Readily Moved About With Lining Bars Employed as Extension Handles

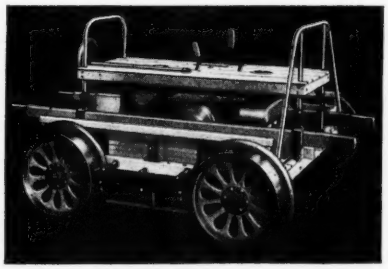
Kalamazoo Brings Out Two New Cars

TWO new track motor cars, known as Models 51 and 52, have been placed on the market by the Kalamazoo Railway Supply Company, Kalamazoo, Mich. Model 51, while designed primarily for one man, will seat two men comfortably. A feature of this car is the use of Alcoa aluminum for the safety rails, skids, braces, axle bearing housings, etc.; thus the weight of the car, it is said, is reduced to the minimum consistent with strength. Another feature is a wheel-type crank furnished with both models, which is designed virtually to eliminate any chance of injury while cranking.

The Model 51 also includes cast iron brake shoes on all four wheels; rail skids mounted on the front and rear axle housings; rubber cushioned axle bearing housings; Timken tapered roller bearings in the four main axle bearing housings; and a Hyatt roller bearing in the steady bearing housing.

Illustrating the Use of the Wheel Crank on the Model 51 Motor Car

Model 52 has the same general construction features as Model 51 except that it has a longer deck and top seat, thereby providing more space for equipment and a seating space for a maximum of four men. Aluminum axle bearing housings are standard equipment on this car, and other parts of Alcoa aluminum can be furnished if desired. Both cars are powered with a single-cylinder, two-cycle engine. High tension magneto ignition of the flywheel type is standard equipment, but battery ignition is available if desired.



The Model 52 Motor Car

Chicago Terminal Co-ordination Plan

A SAVING of $10,502,000 per year is claimed for a plan to co-ordinate the terminal operations of the railroads in Chicago, in a report issued by V. V. Boatner, director, section of regional co-ordination, for the Federal Co-ordinator of Transportation. One of the recommendations is the reduction of the number of major freight yards from 21 to 8, which would reduce yard forces 20 per cent. Another proposes that all l. c. l. operations be taken care of in some 20 freighthouses and transfer stations. It is also proposed to abandon the Grand Central and Dearborn passenger stations and retain only four of the stations now being operated.

Primary Purpose of Ballast

What is the primary purpose of ballast? What characteristics should it possess? What should be the minimum depth for different materials?

To Distribute Load

By P. T. Robinson
Engineer Maintenance of Way and Structures,
Southern Pacific, San Francisco, Cal.

Primarily, the purposes of ballast are to distribute the load over the subgrade, to provide effective drainage under and around the ties, and to permit the track to be surfaced and lined without disturbing the roadbed. To perform these functions, the ballast should be sufficiently hard and tough to resist serious abrasion and pulverizing when tamped. It should possess moderately sharp edges to permit the locking of the individual pieces when it is tamped. It should also have sufficient weight to give it stability, and be free from minerals which might tend to cement it. The best ballast is obtained from ledge or quarry rock crushed to sizes ranging from ¾ in. to 2 in., the smaller sizes tending to fill the voids in the larger sizes so that graded ballast permits more solid tamping. Precious-metal slag also makes high-grade ballast which does not deteriorate readily.

The proper depth of ballast under the ties is a matter of opinion, based on experience and supported by tests. Subgrade conditions have an important bearing on the matter. Subgrades which contain materials subject to deformation, such as clay, loam, etc., should be subjected to uniform pressure under moving traffic loads, for which reason the depth of the ballast should be not less than the tie spacing. If the subgrade is of more stable material which resists deformation, the minimum depth of the ballast should be 12 in. On branch lines over which light power is operated, if the subgrade conditions are normal, from 6 to 8 in. of ballast should suffice. Where rehabilitation work is under way, the old ballast should be leveled to the bottom of the ties to form a sub-ballast, with the new material placed above it to form the top ballast.

Weight and Stability

By M. M. Backus
Assistant Engineer Maintenance of Way, Illinois Central, Chicago

Ballast is a "selected material placed on the roadbed to hold the track in line and surface." Sub-ballast is "any material of superior character which is spread on the finished subgrade, below the top ballast, to provide better drainage, to prevent upheaval by frost and better to distribute the load over the roadbed." Top ballast is "any material of superior character spread over the sub-ballast to support the track, to distribute the load to the sub-ballast and to provide good initial drainage.

Ballast should consist of particles of such weight, shape and relative size that it will not be displaced or eroded readily, or cut into the fibre of wood ties. It should be non-absorbent, clean and retardant of weed growth. Stone ballast, crushed and screened, is graded with respect to its weight per cubic foot, its absorption, its per cent of wear, its hardness, toughness and freedom from tendency to cement.

Two characteristics, weight and stability, especially as related to the cribs, are not always given adequate consideration in connection with the use of anti-creepers. That portion of the ballast in the crib acts as a spacer between ties; it should prevent

Send your answers to any of the questions to the What's the Answer editor. He will welcome also any questions you wish to have discussed.

To Be Answered in May

1. *Is the closing period of a rail-laying or other large maintenance program more productive of accidents than other periods? Why?*
2. *When should a steam or hot-water plant be inspected to determine what repairs are necessary? Why? What details should be observed?*
3. *What precautions should be observed in the use of lining bars to avoid personal injury to trackmen?*
4. *Under what conditions and to what extent is scaffolding required in the repair or replacement of timber trestles? How should it be constructed?*
5. *The present A.R.E.A. specifications for ties limit tolerances to nothing under and 1 in. over the specified dimensions. What are the advantages or disadvantages of this requirement, as compared with the former tolerances of 1 in. shorter and 2 in. longer; 1 in. thicker and ¼ in. thinner; and 3 in. wider and ¼ in. narrower than the specified dimensions?*
6. *What are the relative advantages of steam and oil engines for pumping?*
7. *When laying released rail, is it preferable to use reformed (crowned) joint bars or bars of uniform section? Why?*
8. *What details should be given particular attention when inspecting movable spans? What is the importance of each?*

ties from skewing; and it must provide resistance against the movement of the ties against which the anti-creepers are placed. If the ballast is heavy and remains in position under moving loads, the number of anchors necessary to hold the rail against creeping will be less than where the ballast is light and unstable.

Although the minimum depth for different materials is most important, depth is usually considered in connection with the character of the roadbed, the character and density of the traffic and the cost, rather than the nature of the ballast material itself. One writer contends that to produce approximately uniform pressure on the roadbed, the total depth of ballast under the ties should be not less than the spacing, center to center, of the ties, but that where the material in the roadbed approximates the character of good ballast, the depth need be no more than 12 in.

Theoretically, one might prove that a certain type of ballast, say, crushed stone, will function with less depth under the tie than an inferior ballast, such as cinders. Ordinarily, however, this does not enter into the estimates for new work, or during the application of the ballast as the work is completed. If the initial application is heavy enough and the proper type has been used to prevent the subgrade from working up into the ballast, the additional ballast used in surfacing track in connection with tie renewals and improvement of line and surface will give the depth necessary to provide proper support for the track.

One could elaborate on "the proper type" of ballast on a newly constructed roadbed, for many a mile of newly-laid track has been a continuing source of trouble to the maintenance department because some one exercised poor judgment in selecting the ballast for the initial application.

Depth Will Vary

By Division Engineer

Ballast is placed on the roadbed to hold the track in line and surface, to provide ample drainage, to prevent upheaval by frost and to distribute the traffic load over the roadbed. It is essential that it shall drain freely, be of workable size and possesses good wearing qualities.

Crushed stone should be composed of angular fragments, reasonably uniform in quality, of workable size, durable and resistant to disintegration from tamping. It should be reasonably clean and should be of the sizes specified. Prepared gravel should be composed of hard, strong and durable particles, crushed or uncrushed, free from injurious amounts of soft and friable particles and other deleterious substances, and should conform closely to the sizes specified. Prepared blast-furnace slag should be air-cooled and consist of angular fragments, reasonably uniform in density and quality and reasonably free from thin elongated or glassy pieces, dirt and other objectionable matter; it should also conform closely to the sizes specified.

Owing to the many factors which must be considered, such as the nature of the roadbed, the character of the track and the volume and kind of traffic, the desirable depth of the ballast will vary. For general conditions and for all kinds of ballast materials, the following limiting depths are suggested as being practical and adequate: For track of the class calling for 131-lb. rail, from 30 in. to 22 in.; for 112-lb. rail, 27 in. to 21 in.; for 90-lb. rail, 24 in. to 20 in.

How Large a Stock of Material?

What stock of materials should a bridge or a building gang engaged in general repair work carry with its outfit cars?

Requirements Differ

By H. Austill
Bridge Engineer, Mobile & Ohio, St. Louis, Mo.

Details of organization and work differ between roads and even on different sections of individual roads. For this reason the stock that should be carried will depend on these differences and on the system of storing and handling materials which may be in vogue. If a building gang is supplied from supply cars which are run monthly, its stock should be sufficient to run it at least two weeks beyond the next scheduled trip of the supply cars. If materials are shipped directly from the storehouse, a two weeks' supply should be sufficient. On the other hand, it is more economical to handle lumber in carload lots, for which reason this method of supply might stock some gangs for two or three months.

A bridge gang should carry sufficient material to meet its scheduled requirements for about two weeks. In addition, it should keep an emergency stock sufficient to rebuild about 50 ft. of standard timber trestle. In any event, this latter stock should be large enough to insure against running out before a fresh supply can be gotten to it. For the larger repair jobs, it is often of advantage to ship the material direct to the site of the work to save rehandling. Where this is done, the delivery should be so timed as to insure that the gang will be on hand to unload it upon arrival. Early shipments may keep the car under load too long; delayed shipment may interfere with the ordinary schedule and thus cause a waste of time.

No gang should be required to load on its material cars a large amount of material which must be unloaded in a short time. Neither should material be shipped and unloaded at a station before the gang is there and ready to use it. I recall a case where the staves for a wooden water tank were handled five times before the tank was erected. This was inexcusable, but while an extreme case it is not an isolated one.

On this road bridge and building material was formerly handled from division storehouses. A pile driver was assigned to each division and, so far as bridge and building work went, each division was an independent unit. Piles were bought and shipped direct to the point of use. Lumber was shipped to the division storehouse for distribution, but as soon as the division officers discovered the material was on hand they made requisitions to cover, regardless of the purpose for which it was intended. The result was that the piles were unloaded at a number of trestles, without a check on the number needed, and enough were seldom left at a structure to complete the work planned. In emergencies, the bridge gangs had to load material by hand before they could be moved.

In 1919, the distribution of bridge and building material was established on a system basis and placed under the control of the bridge engineer. In 1924, as a further step, a central storage yard was established. All material purchased is shipped to this storage yard where it is handled by a locomotive crane. As needed, it is shipped to the storekeeper on order from the bridge engineer in time to be on the job when needed and in the order in which it will be used. This has resulted in a large reduction in the cost of bridge maintenance.

We use a single, system pile driver

and in the few emergencies that have arisen both the driver and the needed material were on the ground when the forces were ready for them. Because each gang has a stock of emergency material in its cars, the first train can pick it up without loss of time incurred in loading material.

Stock Reduced by Half

By R. E. Caudle
Assistant Engineer Structures, Missouri Pacific, Houston, Tex.

We require each bridge gang to maintain a minimum stock of material on its outfit cars, consisting of 8 caps, 12 stringers, 60 ties, 12 guard timbers, 16 braces and 24 each of 1, 2 and 3-in. shims. This, with the usable second-hand material which the gangs accumulate normally and keep with their outfit cars, is sufficient to take care of their ordinary requirements for repair work, and will also be enough for most emergencies.

Hardware and other material for the larger jobs of repair and renewal are shipped directly to the work by the stores department, an average supply of hardware for routine requirements for 60 days being kept in the tool car by each gang. In addition, each division headquarters has an emergency stock of piling and timbers sufficient to build a 16-bent trestle. Our experience over a period of years indicates that this stock is satisfactory in every respect.

In emergencies a bridge gang can usually make the needed repairs from the stock it carries. If a greater amount is needed, no time is lost, for the additional material should reach the site by the time the regular supply is exhausted. Each of our gangs has approximately 28,000 lin. ft. of pile and timber trestles to maintain, and we rarely have cases of delay for want of material.

Material and supplies for building and paint gangs are shipped directly to the work, except for a limited amount of staple items, such as small building hardware, nails, glass and a small stock of paint. Through this arrangement our general stock of bridge and building material has been reduced by 50 per cent without causing inconvenience to the forces or delay because of a material shortage.

Track Inspection in Yards

What methods of track inspection should be employed in large yards? In what ways do these differ from those employed on main tracks?

Size Does Not Alter

By P. O. Ferris
Assistant Engineer Maintenance of Way, Delaware & Hudson, Albany, N. Y.

Generally, the size of a yard should not alter the method of inspection, although it may affect the organization through which the inspection is made, since an inspector can cover only so much territory. Owing to the wide differences which are found in different yards, this organization should be left largely to the local officers.

Yard inspection should be made daily by a reliable, competent, experienced and temperate trackman who is intimately acquainted with the yard to which he is assigned. He must be familiar, not only with track construction but with the safe wear of materials, and be able to make emergency repair or adjustment to any part of a turnout. Any work requiring assistance should be reported immediately to the foreman. If he is assigned to night duty, he should keep in touch with the yardmaster's office so he will be available for emergency service in any part of the yard. An inspector in a large yard will usually be kept busy making minor and emergency repairs. He should not be required to do other work as this will tend to cause haste in getting over the yard, to the detriment of thoroughness.

Winter conditions may be severe, and there must be an added inspection of conditions other than the track, which affect the movement of traffic. At this time the inspector must see that snow-melting devices are working properly, that snow and ice are not interfering with the operation of switches and that guard-rail flangeways are clear and to correct gage.

On the road with which I am connected, at present the track forces do not work the full week. On the "lay-off" days the foremen and assistant foremen who are monthly men, make the inspection. This enables the leaders of the gang to acquire a more intimate acquaintance with conditions than they would otherwise be likely to do.

Yards are usually laid with released rail and standards of maintenance are lower than for main tracks. Yet cars must be switched fast and safely, for which reasons the track inspection should be rigid. Inspection should, therefore, be regular, but the frequency will depend on the amount and importance of the traffic handled.

Main-line tracks are constructed of the best of materials, and important main lines are usually equipped with automatic signals which give indications of broken rails or open switch points. In other words, precautions in the way of construction and operation are thrown around the movement of high-speed trains which are not necessary in yards. Yet main-line inspection is still necessary in the interest of safety. Here, however, a reliable man with a motor car can cover a large mileage of main track, while a yard inspector must walk.

A main-line patrolman must be familiar with hand, flag and light signals and must carry flagging equipment to stop trains in an emergency. He must watch for pipes and other defects in rails; for defective drainage and unstable roadbed; for loose rocks, sliding cuts, hanging ice and other possible obstructions to traffic; for close clearances, broken fences, open gates, unlocked switches and fires on the right of way. He must check the operation of flashing signals, the condition of water barrels on bridges, bridge seats, heaved track and shims. He must observe trains for dragging parts and crossings for heaved planks. In a word, he must observe all that a yard inspector should observe and a multitude of items in addition.

Size Makes No Difference

By W. H. Sparks
General Inspector of Track, Chesapeake & Ohio, Russell, Ky.

A large yard is usually a busy yard through which a vast amount of traffic must pass. On the other hand, in normal times, the smaller yards are almost always used to the limit of their capacity, so that in most cases the main leads, the ladders and the body tracks handle individually as much traffic as the corresponding tracks in the larger yards, with the possible exception of the entrance and exit tracks. For these reasons, the size of the yard should make little difference in the methods to be followed as between a large and a moderate sized yard, the principal difference being in the amount of ground to be covered and, therefore, the number of inspectors.

In the first place, the work should be so organized that the ladders, leads

and body tracks, including all turnouts, will receive an inspection daily by a thoroughly competent trackman who is familiar with switch construction and is able to make emergency repairs either by himself or when given the necessary assistance. He should know that all points are fitting and that the switch stands are tight and in good working order.

He should carry a gage and check the gage, particularly at and ahead of the switch and at the frog of each turnout. He should see that all bolts and cotters are in place; that guard rails are set properly and clamped tight; and that foot guards are properly fastened. He should inspect leads and body tracks for gage, surface and line; watch the spiking carefully; and examine the joints.

Every other detail of the track, including ties and tie plates, should be observed closely. Particular attention should be given to noting unsafe conditions, such as draw bars and other car parts which are sometimes left between tracks by car repairers or switchmen. Any defect or unsafe condition which the inspector is unable to correct should be reported promptly to the foreman.

If the inspector is properly trained and is given the right instructions, he should be the most important man in the gang, rating but little below the foreman himself. Normally, the foreman can seldom spare the time necessary to make a thorough and detailed inspection of a yard of any size, so that his inspector becomes his most valuable assistant. The force should be so organized that one or two men are always available to assist the inspector in making minor or emergency repairs when necessary.

An arrangement of this kind should not relieve the foreman in any degree from responsibility for the condition of his yard, or from inspecting any part of it. The purpose is to conserve his time and provide for regular daily inspection, which is clearly beyond his ability if he is to supervise the work of his gang as he should.

There should be no difference in the inspection of a yard track and a main-line track, except so far as the conditions under which the two inspections are made are concerned. The same principles of safety underlie both types of tracks, although they may be maintained to different standards owing to the differences in use.

Standards Will Govern

By Division Engineer

Any system of inspection is governed by the standard of maintenance as well as by the service the facility is expected to give. A yard foreman should inspect the main switching leads every day, but can assign a competent trackman to inspect all other switches and tracks. The inspection should be thorough and in detail. It is important to note evidence of derailments and of switches having been run through. Minor repairs and adjustments should be made by the inspector, but more important work should be reported to the foreman. Dangerous conditions should be classed as "emergency" and the yardmaster should be notified immediately.

Because of the wide differences in local conditions, it is difficult, if not impracticable, to outline a system of inspection which will be suitable in all yards. It should be such, however, as definitely to fix responsibility for safety of operation.

Information for Preframing

Since pile bents cannot always be driven accurately, how can one obtain the information necessary to preframe the timbers for long trestles?

Finds No Difficulty

By E. A. Craft
Engineer Maintenance of Way, Southern Pacific, Houston, Tex.

Our experience has convinced us that pile bents can be driven with the accuracy required for the application of preframed timber in trestles, regardless of length, curvature or other special conditions. This has been accomplished in our renewal work on long trestles driven in swampy ground where the penetration of the piles is as much as 45 ft., as well as in other ground where the driving is very difficult and the penetration shallow.

Trouble Is With Boulders

By L. G. Byrd
Supervisor Bridges and Buildings, Missouri Pacific, Poplar Bluff, Mo.

We have not encountered any particular difficulty in driving our bents accurately enough to permit the assembly of preframed timbers, across the bottom country of the Mississippi and its tributaries, except as will be mentioned later, but to do this requires considerable preparation and care in driving. We do meet with great difficulty at times in hilly and mountainous territory where one is confronted with conditions that include boulders and rock slopes.

It is our custom to locate our bents accurately, setting stakes for the individual piles, and then bore holes from 1 to 4 ft. deep at each pile location to ascertain whether there are any old pile stubs or whether boulders will be encountered at this depth. If any are found which will interfere with the driving, they are removed. Where an existing trestle may have been renewed several times, we make a special effort to find the old bents, in order that we may locate the new ones to clear them.

Where sloping rock is encountered, it may be that some of the bents can be driven to the desired penetration. For the remainder, concrete footings should be constructed and the piles erected on them as posts, the spacing, of course, to accord with the standard preframing plan.

Aside from these natural obstacles, the most difficult problem arises in connection with the changing of the length of our panels from 14 ft. to 12 ft. or 13 ft., since every so often the new and old bents occur at the same point. This can be overcome only by pulling the piles in the bents which interfere with the driving. Obviously, this difficulty does not arise in trestles having 10 or fewer bents.

Locates Bents First

By W. J. Howse
Bridge and Building Foreman, New Orleans & North Eastern, Poplarville, Miss.

We are following a method which, so far, has demonstrated its practicability. Before the timber is preframed, we go over the trestle carefully, marking the locations of the new bents on the deck of the existing structure, making sure that they do not conflict with the present bents. This information is then transferred to the ground, where the position of each pile is established. This gives us the data necessary to enable us to lay out the framing for the deck timbers.

It has been found feasible to drive the bents according to these markings, provided care is exercised in the setting of the piles, so that the preframed deck can be assembled without difficulty. In setting the piles it is of advantage to sink holes 2 to 3 ft. deep with a post hole digger as this

will insure an accurate start. If the bent is located in water, it becomes necessary to set the piles exclusively from the markings on the deck of the structure, and obviously, this requires considerable more time and care. Holes are also bored for starting the batter piles, but to insure accuracy of driving we also use a template from the top of the structure.

How Far Can a Repairman Go?

To what extent should pumpers and district repairmen be expected to maintain electrical equipment at a water station?

Only the Simplest

By E. M. Grime
Engineer of Water Service, Northern Pacific, St. Paul, Minn.

District repairmen or water service foremen on many roads must be jacks of all trades, for they constitute the one class of mechanics who are always available to the operating department for a wide variety of maintenance details, most of which are emergency in character. Besides being the gas-engine, the steam-engine and the pump expert, the water service repairman is usually the first man called when the coaling station machinery fails, the mail crane gets out of order, the turntable sticks or the drawbridge cannot be opened or closed.

If he is a high-class mechanic who can handle all of these details with equal success, it stands to reason that he can also be depended on to make ordinary maintenance repairs to electrical equipment, such as the replacement of a fuse or a switch, or that he can at least determine whether the trouble is of such a nature as to justify the calling of the electrical-service man, who ordinarily covers a more extensive district.

While every one recognizes that the electrical field comprises a science quite apart from ordinary railway maintenance and that in all essential details it requires the services of a specialist, the demand for automatic electrical devices in all sorts of places where electricians are rarely available, has led to the development of safety switches and other safety devices which render the equipment almost fool-proof.

In a modern pumping station, the switches and fuses are usually enclosed in a steel cabinet which is so arranged that to open it a handle must be turned, which automatically cuts off the main current. This makes minor repairs, such as the replacement of a fuse, a safe operation for an inexperienced man. Furthermore, fuses for different amperages are so designed as to shape and size as to make it impossible to replace one with a size not having approximately the correct capacity for the particular circuit.

It appears, therefore, that minor repairs may be handled safely by a reliable water service foreman. On the other hand, there are few men working as pumpers to whom it is safe to delegate such work. A defect which is likely to be discovered by the average pumper is frequently advance evidence of a much more serious failure in the electrical machinery. For this reason, it is seldom advisable to encourage a pumper to attempt any sort of repairs.

An electrician seldom visits a pumping station in which he does not find plenty of work requiring his attention, in addition to the minor repairs for which he may have been called. It is a good rule, therefore, and in line with safe practice, to call on the man who specializes in electrical matters for all but the simplest of repairs which are needed to this class of equipment.

Nothing but Lubrication

By E. L. E. Zahm
Water Service Inspector, Missouri-Kansas-Texas, Parsons, Kan.

Ordinarily, the only form of maintenance which pumpers should be permitted to do on electrical equipment is that of lubrication. However, the correct lubricant and the method and frequency of application should be specified for each installation, and sufficient supervision should be given to insure that the specifications are being followed. A sufficient number of fuses and renewable links of the proper rating should be kept on hand at each water station or treating plant, and these may be applied by the pumpers when the necessity for this is indicated.

Maintenance by district repairmen should be limited to minor adjustments to motors, such as cleaning commutators, replacement or adjustment of motor brushes, the cleaning of switch contact points and the adjustment of float switches. Any repairs to or changes in wiring, magnetic switches, service switches, controls, replacement of motor bearings, or work of a similar nature should be handled solely by electricians.

Reason for a Priming Coat

What is the purpose of a priming coat? Does the mixture differ from that of succeeding coats? If so, how? How should it be applied?

Will Vary With Surface

By Herbert Cunniff
General Painter Foreman, Delaware & Hudson, Green Island, N. Y.

The first coat of paint applied to unpainted lumber or steel, or to a surface from which the old film of paint has been removed, is called the priming coat. Its purpose is to prepare a foundation upon which successive coats may be applied to produce a finished job. Lumber surfaces contain innumerable pores, for which reason the priming coat must be of the proper kind and consistency and must be so applied as to insure the best adherence or anchorage.

Ready-mixed paints may be used successfully for priming, but a particular kind of paint is sometimes preferred. Correct proportions of oil and turpentine are essential, the former to provide proper distribution of the paint film and the latter to insure penetration of the pores in the wood. Quality is essential to satisfactory priming; it is a mistake to assume that the priming coat can be made up of odds and ends since it will be covered by two other coats of good material. A priming coat differs essentially from the succeeding coats in that it should provide a thin, well anchored film that will be particularly receptive to the second coat. This coat, in turn, should be fairly hard and semi-flat when dry, whereas the final coat should contain enough oil to produce a good gloss and a fairly hard surface.

Priming coats will vary between steel and wood surfaces and according to the species of wood to be painted, for which reason no general formula

can be given which can be applied in all cases. Redwood and the cedars and cypresses are most easily penetrated; northern white pine, western white pine and sugar pine follow in order; white fir, hemlock, spruce, ponderosa pine and lodgepole pine fall into the third group; and Douglas fir, western pine, Norway pine, southern yellow pine and tamarack are in the last group, classified in the order of their paint retention. Hardwoods are classified according to the size of their pores, that is, ash, mahogany, oak, etc., which have large pores and, therefore, require a filler before painting. On the other hand, beech, cherry, gum, maple and poplar are examples of woods having small pores, which may be painted without filling.

Priming coats may be applied successfully by either the brush or spray method, although brushing is preferred for the hardwoods. Mill priming of finished lumber is desirable to lessen the absorption of moisture during transit and the building period, particularly when kiln-dried lumber may be exposed to moisture. Back priming—the painting of all surfaces—is desirable in this case to prevent warping, bowing or swelling. This material should also be protected from exposure to the weather, for priming does not render the lumber waterproof; it merely retards the absorption of moisture and thus protects the material against excessive absorption.

Provides a Foundation

By E. C. Neville
Bridge and Building Master, Canadian National, Toronto, Ont.

Priming coats are applied to wood surfaces to fill the pores of the wood and provide a foundation for succeeding coats. If such a coat is not applied, spotting or fading of the paint will occur as a result of the absorption of the oil in the paint by the wood. Priming coats are applied to steel surfaces to inhibit corrosion as well as to provide a foundation for the following coats.

Since wood is porous, it has a relatively high power of absorption, for which reason the priming coat should contain sufficient linseed oil and turpentine to insure penetration and the filling of the pores, so that the later coats will not be robbed of their oil. This coat, like those that follow, should be allowed to dry thoroughly before another coat is applied, to avoid what is commonly known as wrinkling. Care should also be exercised to insure that the wood is thoroughly dry before the priming coat is applied; otherwise, blistering will result. Blistering will also occur if, through leaks or from some other cause, moisture gets under the paint from the inside.

Being a filler, the priming coat naturally requires more oil and turpentine than the succeeding coats. The latter should be prepared in accordance with some satisfactory and dependable formula, and should contain sufficient oil to provide a glossy finish, retaining enough elasticity to insure expansion and contraction corresponding to that of the surface to which it is applied. Failing this, the paint will crack and peel off.

Where Should the Joints Come?

When laying rails of the same length as those released, should the new joints be laid in the same place as the old ones or, say, at the quarter points of the old rail? Why? Does the kind of ballast make any difference? Why?

Keep in Same Place

By L. A. Rape
Extra Foreman, Baltimore & Ohio, Wampum, Pa.

I would not shift the location of the joints unless this became necessary because of some condition which I could not control. The reason usually advanced for shifting the joints is that the new joint will be placed on a more solid and dependable foundation, which is obviously the case. It should not be overlooked, however, that some part of the rail, the quarter under the condition laid down in the question, will be on the old joint ties, which are too high as often as too low. Joints are somewhat more flexible than the remainder of the rail, since the joint fastening does not have the same strength as the rail and the joint bars may bend. Again, the rail ends will work in the joint if the bolts are loose. For these reasons, it will require less of an irregularity in surface to bend the rail at the quarter than at the joint.

I do not see how the kind of ballast can make any difference, since it should be capable of providing a bearing for the ties in any part of the rail. On the other hand, the condition of the ballast may be very important. If the joints are churning and new ballast will not be applied under the new rail, the joints should be shifted.

Makes Little Difference

By O. J. Smith
Rail-Gang Foreman, Chicago & North Western, West Chicago, Ill.

My experience leads me to believe that it makes little difference where the new joints come with reference to the old ones. It would be extremely difficult, if this were required, to make the new joints fall in the same location as the old ones, because even on track that is maintained to a high standard, the expansion in the old rail is seldom uniform, so that the new rail is almost certain to run ahead or behind the old rail. Furthermore, short rails in new and old rail seldom fall at the same place.

When rail is ready for replacement, some of the joint bars are likely to be bent and it is certain that many of them will be worn. In either event, the joint ties may be expected to be low. If the new joints fall on these ties, one can expect some of them to be bent before the surfacing gang arrives. I am in favor of keeping the new joints away from the old ones.

I do not believe that the kind of ballast will make any difference, but its condition will make a great difference. Dirty ballast usually churns at the joints as does ballast that has been in service so long that it has lost its resilience and is "dead." In either case, the new joints should by all means be relocated. This is of much less importance, however, if the ballast is in good condition and the track has been surfaced in advance of the laying of the rail.

Can Be Disregarded

By A. N. Reece
Chief Engineer, Kansas City Southern, Kansas City, Mo.

A number of considerations will determine the location of the new joints with respect to the old ones. If the track is well maintained, there is no particular advantage in changing the location of the joints. The joint ties are quite likely to be supported more solidly than the intervening ties, owing to the more frequent tamping they receive. Generally, therefore, the location of the new joints with reference to the old ones is not particularly important.

If the ballast is of a type that fouls easily or does not drain well, resulting

in churning at the joints, considerable advantage will result from changing the location of the new joints to bring them approximately at the quarter points of the old rail. If it is the practice to space the joint ties, this will also be a factor in determining the location of the new joints, for if they are placed on the old joint ties the expense of respacing will be eliminated. If it is the practice not to space the joint ties, this expense will not be a consideration.

From the practical standpoint, it is difficult to get the new joints to fall in the same place as the old ones. In fact, the tolerance allowed in the length of the rails is sufficient to make this impracticable in a long stretch of new rail, if the expansion allowance is given proper attention. An added difficulty occurs by reason of the use of short rails.

Although all of these considerations will influence the location of the new joints on any particular stretch of new rail, it can be said, in general, that the respective locations of new and old joints can be disregarded on most relaying work.

When to Reballast or Resurface

What factors indicate the need for reballasting or resurfacing track? Of what importance is each?

They Are Different

By C. G. Fulnecky

Assistant District Engineer, New York, Chicago & St. Louis, Frankfort, Ind.

I would not have included resurfacing and reballasting in the same question, for the reason that track is resurfaced several times for every time that it is ballasted. Several factors determine the necessity for resurfacing, all of them being important from the standpoints of maintenance and economy, although there is some difference of opinion as to their relative importance.

Track should be resurfaced when it becomes center-bound, a lift of from 1 to 2 in. generally being sufficient, depending on the kind of ballast and how badly it is center-bound. If tie renewals are heavy, the cost of the renewals will be less and the condition of the track greatly improved by resurfacing. Again, if the track is badly out of cross level, it is well to resurface it. Where new rail is being laid, it is necessary to resurface the track, provided the ballast does not require renewal, to prevent damage to the rail. If the rail has crept enough to slue the ties badly, the ties can be straightened and respaced better and more economically if the track is resurfaced.

Some supervisors and roadmasters believe that track should be surfaced out of face every three or four years. Where this is done, it is common practice to divide the local sections into three or four parts and establish a cycle of resurfacing, at which time the tie renewals are also made.

Reballasting, in which the ballast in the cribs and on the shoulder is dug out and thrown away, becomes necessary when the ballast becomes worn out or very foul. When the ballast is foul, track cannot be made to ride well, since the voids in the ballast are entirely filled and the track loses its resiliency.

Foul ballast impedes drainage, causing sloppy track, churning ties and, eventually, water pockets in the roadbed. Certain kinds of ballast, notably crushed stone, can be cleaned, thus avoiding the necessity for a complete application of new ballast. A paramount reason for clean ballast is the necessity for adequate drainage if the track is to be maintained to a high standard.

Fixed Period Desirable

By Thomas Walker

Roadmaster, Louisville & Nashville, Evansville, Ind.

Among the factors indicating the necessity for reballasting or resurfacing track, in the order of their importance, I would place (1) line and surface, (2) condition of ballast and (3) tie renewals. When the line and surface are in such condition that they cannot be kept to the desired standard without excessive smoothing, these are almost always the most important factors pointing to the need for resurfacing or reballasting. Line and surface are affected, however, by the remaining two factors which have been mentioned.

If the ballast is foul and churning, and cannot be cleaned economically or satisfactorily, the track should be resurfaced and reballasted. If the tie renewals are heavy, they can best be made if the track is raised and surfaced, and this usually requires reballasting.

Another factor which should be considered is the interval since the last surfacing, for track can be better maintained if it is surfaced periodically. Some stretches of track, however, can be allowed to run longer between surfacings than others. If this interval has been allowed to become too long, the evidence will be seen in the condition of the line and surface and of the ballast, although it will usually be more readily distinguished in the line and surface. For these reasons, I believe that there should be a more or less fixed period between surfacings, its length depending to a large extent on the stability of the roadbed.

Factors Are Many

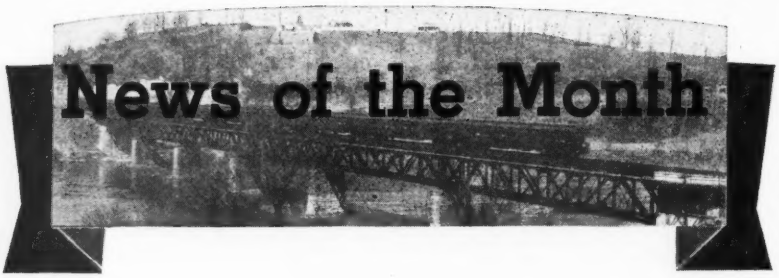
By W. H. Sparks

General Inspector of Track, Chesapeake & Ohio, Russell, Ky.

This question strikes at the very foundation of track maintenance, since good track is impossible unless it has proper support. For this reason, new ballast should be applied when the existing ballast has insufficient depth to give this support. New ballast of better quality should also be applied if the present ballast is of such quality that it has deteriorated from exposure to the weather or is too soft to withstand tamping. Again, even the best ballast obtainable loses its resiliency and becomes "dead" if it is allowed to remain too long without renewal.

Ballast fouls through use, thus retarding drainage, and while some types can be cleaned there is a limit to what can be done in this line, so that reballasting becomes necessary eventually, particularly in the case of ballast having a considerable percentage of small sizes which are lost in the cleaning.

Track should be resurfaced when new rail is laid, where the ties need straightening and respacing and where tie renewals are heavy. After a long period without a resurface, there is a definite tendency to become center-bound, which can be overcome only by resurfacing. At this stage also, the track becomes "dead" and should be resurfaced for this reason as well. Track that has laid too long on an old bed cannot be kept in good line, aside from any difficulty of keeping it in surface.



Burlington Gets Damages

A decision of the United States district court at St. Paul, Minn., on July 11, 1933, awarding the Chicago, Burlington & Quincy $240,000 and interest for damages to its property incurred when the level of the Mississippi river was raised by a dam constructed by the government at Hastings, Minn., was upheld by the United States circuit court of appeals at St. Louis, Mo., on February 11. Water from the dam, which is one of 28 to be built as a part of the government's program for a 9-ft. channel in the upper Mississippi, overflowed 4½ miles of the railroad's tracks, requiring the tracks to be raised an average of 3 ft. In October, 1931, the Burlington brought suit for damages and after a hearing, three commissioners appointed by the federal court awarded, in January, 1932, the damages asked by the railroad. The case was then appealed to the United States district court at St. Paul, and came to trial in April, 1933.

Grade Separations and Super-Highways

The construction of public works on a larger scale than ever before attempted was advocated by Harold L. Ickes, secretary of the interior and administrator of public works, in a recent address. Asserting that "the public works theory has never really been tried and, therefore, cannot have failed in the United States," Mr. Ickes suggested the construction of "super-highways" and the elimination of every grade crossing in the United States as being among the types of monumental public works that could be done on a national scale. His suggestions included three "magnificent super-highways from the Atlantic seaboard to the Pacific, bisected by three or four similar ones running from Canada to the Mexican border, or to the Gulf Coast," and he said that he had long desired to see the elimination of every grade crossing in the United States, "excepting only those on insignificant spur and branch lines that are hardly ever used." "Here indeed," he said, "is an enterprise to engage the interests of the richest nation in the world."

Railroad Net Up for December and Year

For December, 1935, the Class I railways had net railway operating income of $46,040,165, which was a return of 2.90 per cent on their property investment, as compared with a net of $39,225,993, or 2.46 per cent, in December, 1934, according to reports compiled by the Bureau of Railway Economics of the Association of American Railroads. Total operating revenues for December amounted to $296,225,234, as compared with $257,507,786 in December, 1934, an increase of 15 per cent. Operating expenses in December totaled $225,826,310, compared with $194,754,363 in the same month in 1934, an increase of 16 per cent.

For the full year of 1935, these roads had net railway operating income of $500,071,924, or 1.93 per cent, as compared with $465,688,586, or 1.78 per cent, in 1934. This increase in net operating income occurred as a result of higher revenues due to increased freight and passenger traffic. The greatest part of the increased revenue was, however, absorbed by higher operating costs, including complete restoration since April 1, 1935, of the wages of employees to the levels in effect prior to 1932.

Eastman to Order Terminal Unification

Federal Co-ordinator of Transportation Joseph B. Eastman has announced plans for the application of "outside pressure from government authority" to promote greater co-operation among railroads in eliminating competitive duplication, such as at terminals. With a view to obtaining a test of the co-ordination policy of the Emergency Transportation Act and of the authority of the government to enforce it, he has taken the necessary preliminary steps through the issuance of orders requiring the unification of railroad terminal facilities at Worcester, Mass., Mechanicville, N. Y., Grand Rapids, Mich., Jacksonville, Fla., Montgomery, Ala., Meridian, Miss., Freeport, Ill., Des Moines, Iowa, Council Bluffs, Beaumont, Tex., and Ogden, Utah. "While the Co-ordinator would prefer voluntary railroad action," he said, "and has done everything possible to encourage such action, he is convinced that the time has come to use the authority which the act gives him."

Costly Legislation Criticized by Pelley

What the railroads need as much as anything else is to be free from further legislation or regulation that will add to the cost of railroad operation, said J. J. Pelley, president of the Association of National Railroads, in a recent address before the American Institute of Mining and Metallurgical Engineers. Referring to bills affecting labor on railroads that are now pending, Mr. Pelley declared that their enactment would add more than $20 to the cost of transporting each carload of freight. "All that can practically be done," he said, "will be done by the railroads to reduce their operating cost, whether in the direction of unification of terminals, reduction of waste in methods of service, or in other ways. But what advantage will come to shippers or to railroads if the money saved must at once be taken out of the cash drawer to pay increased costs of operation resulting from new legislation or regulations which make impossible continued economies for the railroads without adding anything to their safety, service or revenues?" Mr. Pelley also outlined some of the experiments now being conducted on the railroads with lightweight equipment.

Rail Market Active

During the last month the market for steel rails has been active. Among the larger orders, the Chicago & North Western has ordered 35,000 tons of rails from the Carnegie-Illinois Steel Corporation; the New York Central has ordered about 38,000 tons of rails and large quantities of fastenings from various companies; the Western Pacific has ordered 31,000 tons of rails, placing 10,000 tons with the Columbia Steel Company and 21,000 tons with the Colorado Fuel & Iron Company; and the St. Louis-San Francisco has ordered 17,600 tons of 112-lb. rails from the Tennessee Coal, Iron & Railroad Company. In addition, the Denver & Rio Grande Western has ordered 10,000 tons of rails from the Colorado Fuel & Iron Company; the Atlantic Coast Line has ordered 6,000 tons from the Tennessee Coal, Iron & Railroad Company; the Western Maryland has placed orders for 3,000 tons, 1,500 tons each with the Bethlehem Steel Company and the Carnegie-Illinois Steel Corporation; the Gulf, Mobile & Northern has purchased 3,000 tons from the Tennessee Coal, Iron & Railroad Company; and the Mobile & Ohio has ordered 300 tons of 90-lb. rail from the T. C. I. & R. R. Co.

Cold Weather Helps Travel to Winter Resorts

As a result of sub-zero weather in the middle-west during January and February, travel to the South and to the Pacific coast has shown substantial increases over the same period last year. The New York Central reports a 30 per cent increase in Florida business, while in the period from January 1 to February 5, the Pennsylvania experienced a 22 per cent gain over last year in Florida travel. Similarly the number of passengers carried to Florida on the Chicago & Eastern Illinois increased 57 per cent in January over the same month last year. On the Illinois Central there was an increase of 33 per cent in the number of passengers carried to Florida during the period from January 15 to February 16, while travel to New Orleans, La., also showed improvement. On the Chicago, Rock Island & Pacific, since December 1, more than 15,000 passengers have departed for Arizonia and California on the Golden State Limited and the Apache, while in the period from December 1 to February 10, the Atchison, Topeka & Santa Fe transported 34,168 passengers to California and Arizona. On the Chicago & North Western—Union Pacific, California ticket sales at the city ticket office at Chicago showed an increase of 59 per cent in January, as compared with the same month in 1934.

Supply Trade News

Roadmasters Association

The Proceedings of the last annual convention are now in the hands of the printer and should be ready for distribution to the members late in March.

Metropolitan Track Supervisors' Club

Meeting at the Hotel McAlpin, New York, on the evening of February 20, 35 members and guests of the Club, following dinner, listened to an illustrated talk by E. F. Kenney, metallurgical engineer, Bethlehem Steel Company, on the heat treatment of rails, their manufacture and use. More than an hour of active discussion followed Mr. Kenney's remarks.

Bridge and Building Association

Members attending the convention of the American Railway Engineering Association will join at lunch in the dining room of the Davis Store at 12:30 o'clock on Wednesday noon, March 11. President Strate is calling a meeting of the Executive committee at the Palmer House at 2 o'clock that afternoon.

The Proceedings of the forty-second annual convention are now being set in type and it is expected that they will be mailed to the members the latter part of March.

International Railway Maintenance Club

The International Railway Maintenance Club devoted its meeting at the Hotel Statler, Buffalo, N.Y., on February 13, to the discussion of questions submitted by members. Among the questions which aroused the greatest interest were those dealing with the decay of timber railway structures; the handling of snow at large terminals; the proper seating of rib-bottom tie plates, and the relative advantages of various types of timber for bridge floors.

The next meeting of the club will be held on May 14, at the Royal Connaught hotel, Hamilton, Ont.

Maintenance of Way Club of Chicago

More than 75 members and guests attended the dinner and meeting at the Auditorium hotel on February 24, at which A. L. Bartlett, engineer maintenance of way, New York, New Haven & Hartford, spoke on Track Maintenance Without Section Gangs. No meeting will be held in March, the Club having accepted invitations to join with the Western Railway Club in its meeting at the Hotel Sherman on Wednesday, March 11, and with the Western Society of Engineers on March 23, at its meeting on Inland Waterways.

Personal Mention

General

F. G. Cook, trainmaster-roadmaster on the Northern Pacific with headquarters at Missoula, Mont., has been appointed trainmaster on the Rocky Mountain division, with headquarters at Lester, Mont.

J. S. Miller, assistant superintendent of the Casper-Sheridan divisions of the Chicago, Burlington & Quincy, and formerly a roadmaster on this road, has been appointed superintendent of these divisions, with headquarters as before at Casper, Wyo. Mr. Miller was born on October 6, 1884, at Neponset, Ill., and studied two

J. S. Miller

years at the Missouri School of Mines. He entered railway service in 1905 with the Burlington, serving as a rodman, assistant foreman, foreman and clerk until 1910. From that year until 1915, he served as general track foreman on construction work on various divisions, then being appointed roadmaster, which position he held on the St. Joseph and Aurora divisions until 1917. In that year Mr. Miller was transferred to the operating department as trainmaster on the Galesburg division, then holding this position successively on the Sterling and Casper divisions. In 1933 he was further advanced to assistant superintendent, serving in this capacity on various divisions until his recent appointment as superintendent of the Casper-Sheridan divisions, effective February 1.

Fred C. Paulsen, assistant superintendent on the Central district of the Union Pacific, and formerly a division engineer on this road, has been promoted to superintendent of the same district, with headquarters as before at Pocatello, Idaho. Mr. Paulsen was born at Omaha, Neb., and entered the service of the Union Pacific in May, 1903, in the mechanical department at Omaha. Later he was transferred to the engineering department where he served as a rodman, instrumentman, draftsman, assistant engineer, office engineer and division engineer. He also served as a roadmaster and as an accountant. In 1926 Mr. Paulsen was transferred to the operating department as assistant superintendent, which position he held until his recent appointment.

H. H. Harsh, division engineer of the Akron division of the Baltimore & Ohio, with headquarters at Akron, Ohio, has been promoted to assistant superintendent of the Chicago division, with headquarters at Garrett, Ind. Mr. Harsh has been connected with the Baltimore & Ohio almost continuously since June 1, 1906, when he became an assistant on the engineering corps on the Chicago division. He left the company in September of the same year but returned on June 26, 1907, in the same capacity at Parkersburg, W. Va. Mr. Harsh next served on the Wheeling division as a chairman and transitman, then being appointed assistant division engineer at Newark, Ohio, on August 1, 1910. On June 12 of the following year he was transferred to the office of the chief engineer of maintenance, Baltimore, Md., being promoted to division engineer at Wheeling, W. Va., on January 1, 1912. Later he served in the same capacity successively at Cleveland, Ohio, Chicago, Pittsburgh, Pa., and Akron, being located at the latter point at the time of his recent promotion to assistant superintendent.

Engineering

W. E. Heimerdinger, roadmaster on the Chicago, Rock Island & Pacific at Haileyville, Okla., has been appointed division engineer of the Cedar Rapids-Dakota division, with headquarters at Cedar Rapids, Iowa, succeeding **F. Nugent,** who has been assigned to other duties.

J. W. Purdy, assistant division engineer on the Ohio division of the Baltimore & Ohio, with headquarters at Cincinnati, Ohio, has been promoted to division engineer of the Akron division, with headquarters at Akron, Ohio, succeeding **H. H. Harsh,** whose appointment as assistant superintendent is noted elsewhere in these columns. **R. W. Gilmore,** track supervisor at Lima, Ohio, has been promoted to assistant division engineer on the Ohio division, to replace Mr. Purdy.

Charles E. Hise, whose appointment as principal assistant engineer of the Chicago, St. Paul, Minneapolis & Omaha (part of the Chicago & North Western System), with headquarters at St. Paul, Minn., was noted in the January issue, was born on May 22, 1895, at Colfax, Iowa. Mr. Hise first entered railway service on April 1, 1912, as a tapeman on the North Western at Boone, Iowa, and has served with this company continuously except for the period from May 1, 1913, to July 31, 1914, when he served as a rodman on the Chicago, Rock Island & Pacific, and for the period from May 1, 1915, to April 30, 1917, when he was an instrumentman on the Wabash. On May 1, 1917, he was appointed an instrumentman on the North Western, being promoted to assistant engineer in the engineering auditor's office at Chicago in

March, 1920. Three years later Mr. Hise was transferred to the Dakota division, at Huron, S. D., and in February, 1925, he was assigned as assistant engineer to the accounting department at Chicago. From April to September, 1928, Mr. Hise acted as assistant engineer in charge of

Charles E. Hise

the laying of new rail on approximately 130 miles of track on the Galena and Southern Illinois divisions, then being transferred to the Northern Iowa and Sioux City divisions, with headquarters at Sioux City, Iowa, where he was located at the time of his recent appointment as principal assistant engineer of the Omaha.

Track

J. N. Sagester, track supervisor on the Columbus division, has been transferred to the Cincinnati division, with headquarters at Richmond, Ind., to succeed **E. R. Burchette,** deceased.

George Brum, a track inspector on the Chicago, Rock Island & Pacific, has been appointed roadmaster at Haileyville, Okla., succeeding **W. E. Heimerdinger,** whose appointment as division engineer is noted elsewhere in these columns:

S. A. Temple, assistant engineer on the Baltimore & Ohio, has been promoted to track supervisor, with headquarters at Lima, Ohio, succeeding **R. W. Gilmore,** whose appointment as assistant division engineer is noted elsewhere in these columns.

Lee Taylor, who has been connected with the office of the division engineer on the Gulf, Colorado & Santa Fe at Temple, Tex., has been promoted to roadmaster with headquarters at Brownwood, Tex., succeeding **C. C. Robinson,** who has retired.

C. H. Burgess, division roadmaster on the Northern Pacific, with headquarters at Missoula, Mont., has been appointed trainmaster-roadmaster, with the same headquarters, to succeed **F. G. Cook,** whose appointment as trainmaster is noted elsewhere in these columns. **G. M. deLambert,** district roadmaster at Helena, Mont., has been appointed division roadmaster on the Fargo division, with headquarters at Fargo, N. D., to replace **H. Heleen,** who has been transferred to Missoula, to succeed Mr. Burgess. **H. W. McCauley,** roadmaster at Mandan, N. D., has been transferred to Helena, to replace Mr. deLambert. **Fred Schaumberg** has been appointed roadmaster at Mandan, to replace Mr. McCauley.

M. Young has been appointed assistant supervisor on the Baltimore division of the Pennsylvania, with headquarters at York, Pa., to succeed **J. C. Skinner,** who has been transferred to the Philadelphia Terminal division. **T. J. Murray,** supervisor on the Monongahela division, has been transferred to the Maryland division, with headquarters at Wilmington, Del., to succeed **J. P. Newell,** who has been appointed acting assistant division engineer on the Middle division. **E. G. Adams,** assistant supervisor on the Philadelphia Terminal division, has been promoted to supervisor on the Baltimore division, with headquarters at York, Pa. **H. S. Unangst,** supervisor on the Baltimore division, has been transferred to the Pittsburgh division.

William G. Ashworth, division roadmaster on the Tacoma division, with headquarters at Tacoma, Wash., has been appointed trainmaster-roadmaster, with headquarters at Centralia, Wash. **Marquis L. Hare,** division roadmaster at Glendive, Mont., has been transferred to Tacoma, to replace Mr. Ashworth and **Raymond W. Davis,** district roadmaster, with headquarters at Laurel, Mont., has been appointed division roadmaster at Glendive, to replace Mr. Hare. **Ben Lee** has been appointed roadmaster at Laurel, to relieve Mr. Davis. **Roger L. Stewart,** district roadmaster at Centralia, has been transferred to Tacoma, to succeed **Charles F. Nelson,** who has retired.

William G. Pfohl, whose promotion to supervisor of track on the Pennsylvania, with headquarters at Clayton, Del., was noted in the February issue, was born on May 7, 1906, at Princeton, Ind., and was graduated in civil engineering from Purdue University in 1928. He entered railway service on the Eastern division of the Pennsylvania as an assistant on the engineer corps, with headquarters at Pittsburgh, Pa., on March 11, 1929, and later served in this capacity on the Buffalo, Panhandle and Pittsburgh divisions, until May 5, 1932, when he was furloughed. On August 1, 1933, he returned to the Buffalo division as assistant supervisor with headquarters at Buffalo, N. Y., and on February 23, 1934, he was transferred to the Pittsburgh division, with headquarters at Johnstown, Pa.

Bridge and Building

D. E. Saurer, assistant master carpenter on the Fort Wayne division of the Pennsylvania, has been appointed master carpenter of that division, with headquarters at Ft. Wayne, Ind., succeeding **F. H. Mitchell,** retired.

Harry M. Mason has been appointed general foreman of bridges and buildings on the Atchison, Topeka & Santa Fe, with jurisdiction over the Denver, Pueblo, Canon City, Rockdale, Minnequa, and Grand Valley districts of the Colorado division, with headquarters at Pueblo, Colo., succeeding **J. L. Talbott,** who has retired.

T. H. Harrington, general masonry foreman on the Canadian National with headquarters at Toronto, Ont., has been promoted to bridge and building master, with headquarters at Montreal, Que., to succeed **Harold Toms,** whose death on August 25, 1936, was noted in the November issue.

Obituary

E. R. Burchette, track supervisor on the Cincinnati division of the Pennsylvania, with headquarters at Richmond, Ind., died on January 28.

C. F. Green, retired supervisor of bridges and buildings on the Southern Pacific, died at his home at Sacramento, Cal., on December 10.

John J. Baxter, assistant chief engineer of the Wabash with headquarters at St. Louis, died on February 20 of pneumonia and heart disease at St. John's hospital

John J. Baxter

in St. Louis, Mo., following an illness of three weeks. Mr. Baxter was born on July 10, 1882, at Moberly, Mo., and received his higher education at the University of Missouri. He entered railway service in 1902 as a rodman on the Wabash and later served with the Chicago, Burlington & Quincy, the Mexican National and the Kansas City Terminal as an instrumentman and assistant engineer. He served also as office engineer and chief computer in the construction and valuation department of the Burlington. Mr. Baxter returned to the Wabash on May 1, 1918, as assistant engineer at St. Louis, being promoted to division engineer, with headquarters at Peru, Ind., a month later. On October 1, 1923, he was further advanced to assistant chief engineer.

Skilsaw Portable Electric Tools—Skilsaw, Inc., Chicago, has issued general catalog No. 36, which lists and describes the complete line of portable electric tools manufactured by this company. This catalog, which contains 36 pages, is attractively printed and illustrated.

Here's *Strength...*

FOR ANY LOADING CONDITION!

- *Greater capacity per pile.* permits use of fewer piles. Size and cost of cofferdams can be reduced . . . less excavation for footings needed.
- *Permit faster, easier driving.* The rigidity and stiffness of steel insures that full force of driving ram is available for securing penetration.
- *Drive to desired penetration* under severe conditions that make other types unusable. No jetting necessary.
- *Splicing in the field is easy.* No special handling or placing equipment necessary. They're tough to stand rough treatment. Require less space in storage and shipment.
- *Permanent.* Examinations of steel piles in hundreds of bridges installed 25 to 35 years ago disclose the fact that loss of metal from corrosion is negligible.

CBP STEEL BEARING PILES

...and shipment from stock to quickly serve your needs

CBP BEARING PILES offer the bridge and structural engineer two important and outstanding advantages:—Steel sections especially designed for efficient use as bearing piles . . . and an unfailing, dependable source of supply that makes them *immediately* available.

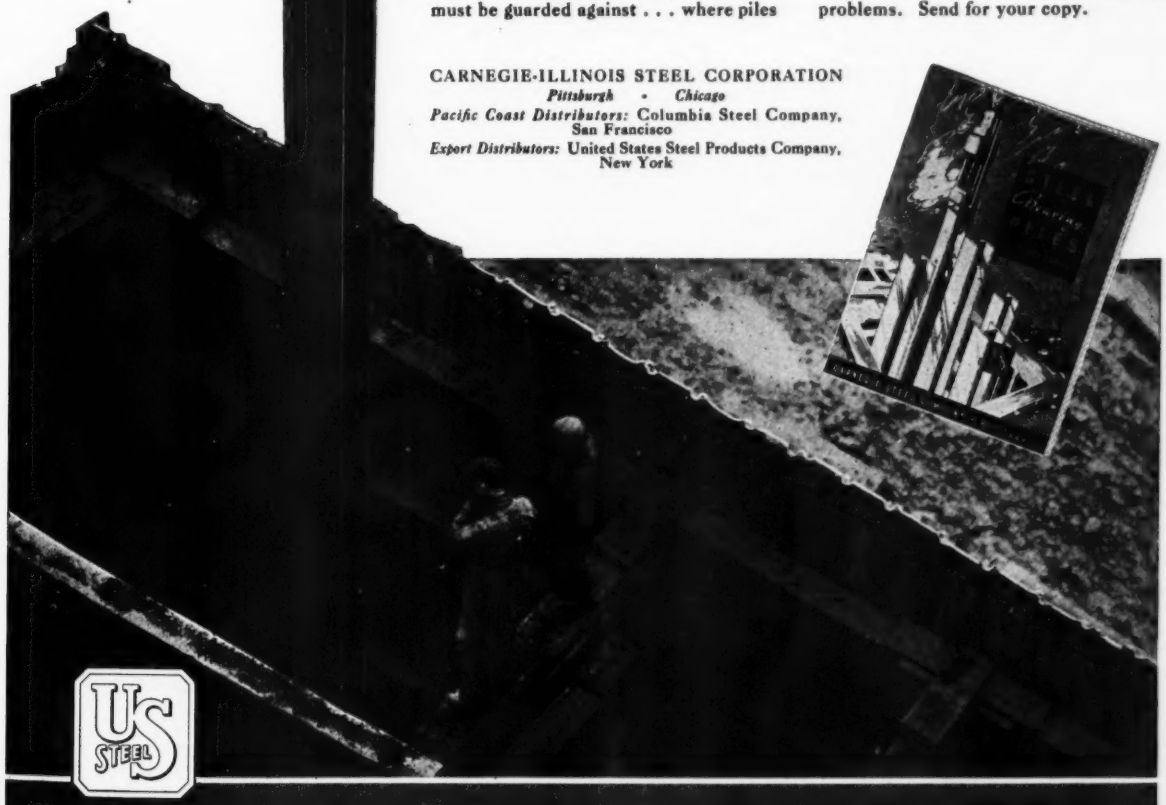
CBP Bearing Piles are recommended wherever exceptionally hard driving conditions are encountered . . . where heavy loads must be carried on individual piles . . . where substantial bottoms are difficult of access . . . where the scouring effects of steam-borne sand and rock must be guarded against . . . where piles are subject to destruction by borers, termites and other organisms . . . where the pile must resist high bending stresses . . . and where the pile sections must act both as bearing piles and as the columns of trestle bents. Under these conditions CBP Steel Bearing Piles insure lasting and economical construction.

And remember this: Large stocks of CBP Bearing Piles in all sizes are carried at our mills. Your orders go out with least delay. There's no waiting for shipment.

• • •

Have you this book? The first of its kind ever published. 80 data-filled pages, profusely illustrated. Facts, figures and practical information on pile foundations and pile driving never before generally available. Entirely new material based on recent tests. Of vital importance to every one concerned with foundation problems. Send for your copy.

CARNEGIE-ILLINOIS STEEL CORPORATION
Pittsburgh • *Chicago*
Pacific Coast Distributors: Columbia Steel Company, San Francisco
Export Distributors: United States Steel Products Company, New York



UNITED STATES STEEL

Supply Trade News

General

The Toncan Culvert Manufacturers Association has moved its offices from Youngstown, Ohio, to the Republic building, Cleveland, Ohio.

The Ingot Iron Railway Products Company, Middletown, Ohio, has opened an office at Richmond, Va., at 1308 State-Planters Bank building, and has placed **R. S. Stimson** in charge, with the title of district manager. Formerly with the engineering department of the Chicago, Burlington & Quincy for 13 years, Mr. Stimson was connected with the general office of the Ingot Iron Railway Products Company at Middletown.

Personal

Albert F. Huber, assistant chief engineer of the **Ramapo Ajax Corporation,** and chief engineer of its East St. Louis, Ill., plant, has been appointed chief engineer of the corporation. Mr. Huber was born in 1889 at Kansas City, Mo. He was educated in the public schools of St. Louis, then completed the academic course at St. Louis University and also took a number of extension courses in engineering and mathematical subjects at Washington University, St. Louis. He entered the employ of the Elliot Frog & Switch Company as a draftsman in 1906,

Albert F. Huber

and except for a short period in 1908, was in the engineering department of this company until it was consolidated in 1924 with the Ramapo Ajax Corporation, is a member of the Standardization committee of the Manganese Track Society. Mr. Huber will be located at the offices of the Ramapo Ajax Corporation in Chicago.

L. A. Paddock, president of the **American Bridge Company,** a subsidiary of the **United States Steel Corporation,** has been elected also president of the **Virginia Bridge Company.** The latter company was purchased recently by another subsidiary of the United States Steel Corporation, the **Tennessee Coal, Iron & Railroad Company.**

Ralph E. Meyers, who has been appointed manager of sales of the **International Creosoting and Construction Company,** as announced in the February issue, was born in Cincinnati, Ohio, on July 11, 1899. After graduating in chemical engineering at the state university of New Mexico in 1919, he served as instructor in chemistry at this college for two years. He was then employed as research chemist for the Chino Copper Company at Hurley, N. M., for a year. Late in 1922 he entered the employ of the International Creosoting and Construction Company as plant chemist at its Texarkana, Tex., plant. Three years later he was placed in charge of all chemistry work for this company, with headquarters at Galveston, Tex., which position he occupied until his present appointment to the position of manager of sales, which became effective on January 1.

Mr. Meyers has taken an active part in the work of various technical associations.

Ralph E. Myers

He worked in 1928-1930 with the American Standards Association's committee on the Strength of Pole Woods, developing the present widely accepted standards for pole strength. He is now a member of the Executive committee of the American Wood-Preservers Association.

Frederick H. Thompson, vice-president and director of the **Simmons-Boardman Publishing Company,** publishers of *Railway Engineering and Maintenance,* Railway Age, and other transportation papers, has been elected also to the board of directors of its parent company—the **Simmons-Boardman Publishing Corporation. Frederick C. Koch,** vice-president of the Simmons-Boardman Publishing Company and business manager of *Railway Engineering and Maintenance,* has been elected to the board of directors of that company.

Mr. Thompson, who was born in Cleveland, Ohio, started his business career in 1902 as a newspaper reporter in New York and served for a time as a dramatic critic. From 1904 to 1907, he was eastern representative of the Music Trade Review, becoming in the latter year business manager of the American Engineer and Railroad Journal, a position which he held until 1912, when that publication was merged into the Railway Mechanical Engineer, a Simmons-Boardman publication. Shortly after the merger, Mr. Thompson joined the Simmons-Boardman organization as business man-

Frederick H. Thompson

ager of the Railway Mechanical Engineer, serving in that connection from 1912 until 1920, when he was appointed general manager of the Simmons-Boardman Publishing Company in the Central district, with headquarters at Cleveland, Ohio. In 1924 Mr. Thompson was elected a vice-president. He was elected to the Simmons-Boardman Publishing Company directorate in 1931.

Mr. Koch was born in Jersey City, N. J., on June 9, 1893, and was educated in the public schools of New York. He entered the employ of the Railway Age-Gazette in 1909 in a minor capacity, and rose through various clerical positions to the managership of the advertising make-up department. In 1917 he became ad-

Frederick C. Koch

vertising sales representative for all Simmons-Boardman transportation publications, with the title of assistant to vice-president. In 1925 he was appointed business manager of *Railway Engineering and Maintenance,* which position he still holds along with the vice-presidency of the Simmons-Boardman Publishing Company, to which capacity he was elected in 1931.

Tempo depends on Track

RAILROAD equipment cannot get anywhere, at any speed, without tracks. And the faster the speed the better the tracks must be.

> Maintenance officers have been quick to realize that a train cannot be expected to ride better than the track over which it runs, and that these higher speeds can be maintained only if the refinement in maintenance keeps pace with the demands they make on track. We are unlikely to revert to the speeds of yesterday and those of tomorrow may be more severe in their demands on track than those of today. These new trains therefore challenge railway managers

Railway Age
Page 731, November 30, 1935

Trains can't get from one track to another without FROGS and SWITCHES. Managements can't afford anything but the BEST frogs and switches, which means the kind that require the LEAST MAINTENANCE.

Wherever the need is for GREATER SPEED—a faster railroad TEMPO—safety and economy demand the most up-to-date track equipment, which fortunately is also the most economical to maintain. We refer particularly to Manganese track fixtures.

The standards as set forth in A.R.E.A. Portfolio of Trackwork Plans and Specifications are the result of years of experience. They are a sound foundation to build on for present and future speed requirements. Starting from this basis, the members of this Society are alert in offering improvements that make for increased safety and reduced maintenance costs.

MANGANESE TRACK SOCIETY

A National Organization

17 JOHN STREET - - - NEW YORK, N. Y.

M&L Track Construction

A Stronger–Safer and Better Riding Track With Reduced Maintenance Charges

M & L Track is a proved, sturdy, unified structure affording all the important functions of the highest standards of track construction.

With this superior construction, axle loads are distributed over more ties—there is less pumping of track—and ties do not roll. The vertical motion of the rail and of the tie are greatly reduced although the normal wave motion of the rail is permitted to pass freely.

M & L Track assures a greater permanence of the road bed because M & L Track stays in line and surface for longer periods. The spring clips hold the rail to place. There is no creepage. So well is the rail restrained that changes in length due to expansion and contraction are prevented.

Over 200 miles in service prove that M & L construction is the economical track assuring **longer life for rails, joints and ties,** and a big reduction in many other important items of maintenance expense.

M & L construction permits the immediate use of the continuous welded rail, giving such superior riding qualities and safety that M & L is justly known as the **VELVET TRACK**

THE RAILS COMPANY

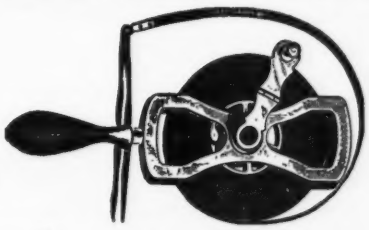
50 Church Street **New York, N.Y.**

RUGGED SLUG *Devil* MAULS

WARREN TOOL CORP.
WARREN, OHIO

LUFKIN Measuring Tapes and Rules

for **Engineering**
Construction
Maintenance
and all general measuring purposes.



Sturdy and Dependable
They meet every requirement
Send for Catalog

THE LUFKIN RULE CO. SAGINAW, MICHIGAN, 106-110 Lafayette St., New York.

ALPHABETICAL INDEX TO ADVERTISERS

and list of their products